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NPSI MPRD 2.2

NAVAIR PORTABLE SOURCE INITIATIVE (NPSI) STANDARD FOR MATERIAL PROPERTIES REFERENCE DATABASE (MPRD)

Prepared For:

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NAVAIR Aviation Training Systems PMA 205


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1. Introduction

NPSI is a simple concept with a simple goal to minimize the waste and redundancy in database production without inhibiting innovation. The basic concept of NPSI is to capture value added work performed on raw source data. This concept has resulted in significant cost savings to many Department of Defense (DoD) programs by minimizing the amount of raw source data required to be purchased and processed. The NPSI archive stores refined source data in datasets and makes the datasets available for utilization by future programs. To better facilitate sensor simulation interoperability, the NPSI Material Properties Reference Database (MPRD) was established as a component of the NPSI metadata architecture to provide a common set of material properties and a common mechanism for referencing and enumeration. This document is intended to serve as a reference for users of NPSI datasets containing MPRD attribution.

1.1 XML and Material Markup Language (MatML)

The NPSI MPRD is intended to contain a catalog of material properties data and metadata that may be referenced in simulation datasets. Based on eXtensible Markup Language (XML) technology, the "container" is intended to be extensible, allowing new definitions of material properties and data types to be added progressively. However, the data structure must conform to a universal standardized format to allow interoperability and data interchange with minimum user intervention. The structural definition, logical relationships, and business rules of a database is summarized in a "schema." In XML technology, a schema is also a validating document that defines the "grammar" of an XML document. When an XML database document is validated against a schema, the structural conformity and business rules are enforced.

As an example, consider the following information table for metal:

| Material ID | Description | Melting Point | Heat Capacity |
|-------------|-----------------------|-------------------|---------------|
| MZ100 | Metal, Titanium Alloy | 1550 – 1600 Deg C | 7 W/m-K |

The data is presented in HTML as:

```
<tr>
<td> MZ100 </td>
<td> Metal, Titanium Alloy </td>
<td> 1550 – 1600 Deg C </td>
<td> 7 W/m-K </td>
<tr>
```

HTML represents the data in its display format; however, the collective identity and structure of the object are lost. In contrast, XML preserves the structure of the object by using custom tags that are descriptive to the nature of elements. Consider this generic example of XML formatted data:

```
<Metal>
  <Material ID> MZ100 </Material ID >
  <Description> Metal, Titanium Alloy </Description>
  <Thermal Property>
    <Melting point>1550 – 1600 Deg C </Melting point >
    <Heat capacity> 7 W/m-K </Heat capacity >
  </Thermal Property>
</Metal>
```

The focus of XML is the data and the structure of the data. The meaningful nature of the components promotes the interchangeability of the data across heterogeneous platforms. The self-documentation and structure preservation inherent in XML facilitates interoperability between applications, as desired under the NPSI program.

The Material Markup Language (MatML) XML schema has been adopted and extended as the basis for MPRD schema. The National Institute of Standards and Technology (NIST) initiated MatML in 1999 as an attempt to consolidate the mostly proprietary formats of material resources. MatML was conceived out of the efforts from private industries, government labs, and universities to define a standard and descriptive document structure to enable universal interchange for materials property data. More information regarding MatML is available at (<http://www.matml.org>).

2. Organization of the Data

2.1 Classes and Subclasses

MPRD materials are organized by material *class* and *subclass*. The definitions of class and subclass are not rigid, but a common nomenclature and convention can help with the overall organization. Listed below are MPRD standard classes:

2.1.1 Classes

- ROCK
- SOIL
- MINERAL
- VEGETATION
- COATING
- LIQUID
- METAL
- CONSTRUCTION
- PLASTIC
- WOOD
- GLASS
- FABRIC

2.1.2 Subclasses

Subclasses are created using relevant taxonomy from the authority in a particular class. Some examples of subclasses nomenclature in MPRD are:

Subclasses for SOIL

- Oxisols
- Vertisols
- Aridisols
- Ultisols
- Mollisols
- Alfisols
- Inceptisols
- Entisols

Subclasses for ROCK

- Igneous
- Sedimentary
- Metamorphic

Subclasses for MINERAL

- Native_elements
- Sulfides
- Oxides
- Hydroxides
- Halides
- Carbonates
- Nitrates
- Borates
- Phosphates
- Sulfates
- Tungstates
- Silicates

Subclasses for VEGETATION

- Tree
- Shrub
- Forb
- Vine
- Graminoid
- Cactus
- Fern
- Lichen
- Bryophyte

MPRD Material Library is conceptually organized as a conventional library of books. A group of materials is placed in one "book," the abstraction of an XML file. Each "book" may contain the information for one or many materials with their properties. Usually materials of the same *subclass* are collected in a "book." Books (xml files) from the same class are shelved on the same shelf (folder). See Figure 1 below as an example.

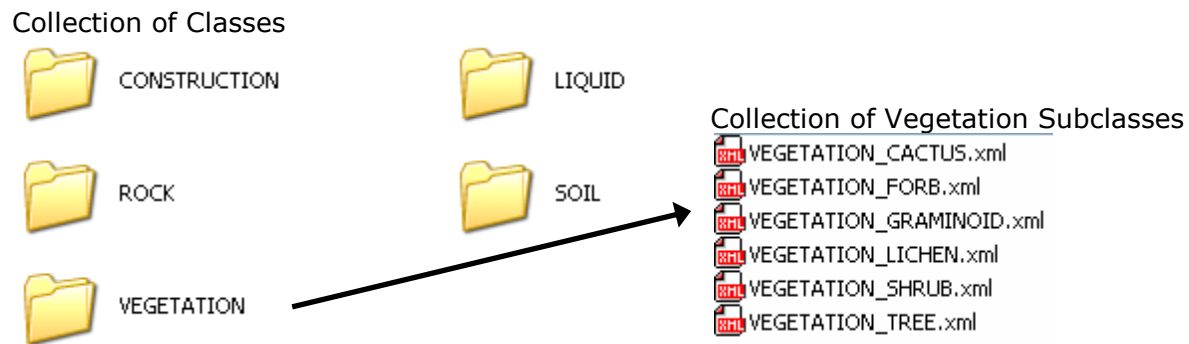


Figure 1 MPRD Classes and Subclasses Example

2.2 Dictionary

There are two types of dictionaries: local and global. Each XML file for a subclass of materials contains a local "dictionary." The local dictionary is an XML data structure that defines the terms and variables used in the specific XML file.

For definitions of global scope, the global dictionary file is created as a standalone XML file. This global dictionary must be referenced to interpret the terms and variables used in any of the material XML files.

2.3 Data Packaging

The MPRD library is transmitted as a set of folders. A summary of these folders and their content follows.

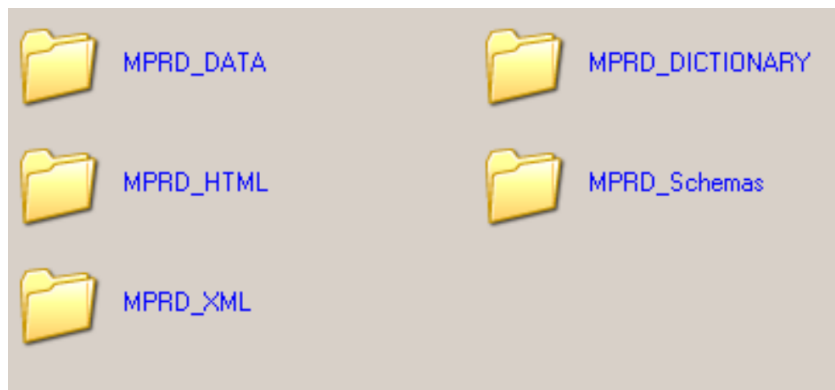


Figure 2 MPRD Package

2.3.1 MPRD_XML

This is the main folder that stores all the material properties databases in XML format. Included in the XML folder are style-sheets that may be used to display the XML data with Internet Explorer.

2.3.2 MPRD Dictionary

2.3.3 This is the folder that stores the global dictionary database in XML format.MPRD Data

This is the folder that stores all referenced data that are not embedded directly in the MPRD XML files. As an example, some large spectral distribution data associated with materials are externally referenced here rather than inline in the individual material property XML files.

2.3.4 MPRD Schema

This is the folder that stores all schemas used to validate and load the MPRD XML files.

2.3.5 MPRD HTML

This is the folder that stores the transformed XML files in HTML format. This folder as a whole can be used and viewed without the other previously mentioned folders and may be useful for viewing a summary of the MPRD library catalog without parsing actual data.

3. MPRD Illustrative Examples

The following illustrations are intended to give a visual representation of the overall typical MPRD data using the MPRD schema documented in this standard. The illustrations were captured from transformed XML files into HTML pages using the attached XML Style-sheet. Note that not all of the data in the MPRD are rendered by the style-sheet.

3.1 MPRD Catalog

MPRD_Catalog.xml is a catalog that lists the available materials in the MPRD_XML library.

| MPRD LIBRARY MATERIAL LIST | | | |
|----------------------------|----------|------------|---|
| CLASS | SUBCLASS | REV DATE | MPRD_ID |
| LIQUID\LIQUID_WATER | | | |
| Liquid | Water | 2005-06-14 | Liquid_Water_Distilled |
| Liquid | Water | 2005-06-14 | Liquid_Water_Sea |
| SOIL\SOIL_ARIDISOL | | | |
| Soil | Aridisol | 2005-06-14 | Soil_Aridisol_Argid_Forkwood GrayishBrownLoam |
| Soil | Aridisol | 2005-06-14 | Soil_Aridisol_Argid_Penistaja BrownFineSandyLoam |
| Soil | Aridisol | 2005-06-14 | Soil_Aridisol_Argids_CasaGrande FineSandyLoam |
| Soil | Aridisol | 2005-06-14 | Soil_Aridisol_Calcid_Mivida YellowishRedFineSandyLoam |
| Soil | Aridisol | 2005-06-14 | Soil_Aridisol_Cambid_Orovada FineSandyLoam |
| VEGETATION\VEGETATION_TREE | | | |
| Vegetation | Tree | 2005-06-14 | Vegetation_Tree_Quaking Aspen |
| Vegetation | Tree | 2005-06-14 | Vegetation_Tree_Sierra Lodgepole Pine |
| Vegetation | Tree | 2005-06-14 | Vegetation_Tree_Silver Maple |
| Vegetation | Tree | 2005-06-14 | Vegetation_Tree_Subalpine Fir |
| Vegetation | Tree | 2005-06-14 | Vegetation_Tree_White Oak |

3.2 LIQUID WATER Example

The following data is rendered from a subset of the LIQUID_WATER.xml file. This is a sample collection of LIQUID class and WATER subclass materials.

Header Information

LIQUID/LIQUID_WATER

| | |
|------------------------|----------------|
| INDUSTRY CONTACT : | mailto: |
| GOVERNMENT CONTACT : | NAVAIR Orlando |
| LICENSE TYPE : | PUBLIC_DOMAIN |
| LICENSE RESTRICTIONS : | |
| CLASSIFICATION TYPE : | UNCLASS |
| HANDLING CAVEAT : | |
| REVISION : | 2.1 |
| LAST REVISED DATE: | 2006-09-01 |

Distilled Water Material Data

| MPRD_ID : Liquid_Water_Distilled | | | CLASS : Liquid | |
|---|---|--------------------|--|--------------------------------------|
| | | | SUBCLASS : Water | |
| | | | DATE : 2005-06-14 | |
| Property Name | Data Source | Specimen Name | Data (qualifier) [parameter] | Unit |
| specific heat capacity p-special_heat_capacity | US Coast Guard manual ds-US_CoastGuard | sp-distilled-water | 4213,4201,4188,4184,4180,4176,4176,4176,4176 pa-testTempF [test Temperature (F) : 32,40,50,60,70,80,90,100,110,120F] | J/kg- joule per kilogram K Kelvin |
| density p-density | US Coast Guard manual ds-US_CoastGuard | sp-distilled-water | 1000,1000,1000,999,998,996,995,993,991,988 pa-testTempF [test Temperature (F) : 32,40,50,60,70,80,90,100,110,120F] | kg/m^3 kilogram per cubic meter |

| | | | | |
|---|---|-------------------------------------|---|-------------------------------------|
| thermal conductivity p-thermal_conductivity | US Coast Guard manual ds-US_CoastGuard | H2O-Ice GDS136 sp-distilled-ice1 | 2.7,2.65,2.59,2.53,2.47,2.41,2.35,2.29,2.23 pa-testTempF [test Temperature (F) : -50,-40,-30,-20,-10,0,10,20,30F] | W/m-K watt per meter Kelvin |
| specific heat capacity p-special_heat_capacity | US Coast Guard manual ds-US_CoastGuard | H2O-Ice GDS136 sp-distilled-ice1 | 1675,1729,1784,1834,1888,1943,1993,2047,2102 pa-testTempF [test Temperature (F) : -50,-40,-30,-20,-10,0,10,20,30F] | J/kg-K joule per kilogram Kelvin |
| density p-density | US Coast Guard manual ds-US_CoastGuard | H2O-Ice GDS136 sp-distilled-ice1 | 924,923,923,922,922,915,921,920,920 pa-testTempF [test Temperature (F) : -50,-40,-30,-20,-10,0,10,20,30F] | kg/m^3 kilogram per cubic meter |
| thermal conductivity p-thermal_conductivity | US Coast Guard manual ds-US_CoastGuard | sp-distilled-water | 0.567,0.574,0.582,0.591,0.599,0.607,0.616,0.624,0.633,0.641 pa-testTempF [test Temperature (F) : 32,40,50,60,70,80,90,100,110,120F] | W/m-K watt per meter Kelvin |
| reflectance p-reflectance | USGS Digital Spectral Library ds-USGS | H2O-Ice GDS136 sp-distilled-ice1 | Path : local-usgs-L- ..\MPRD_DATA\pubs.usgs.gov\ofl2003\ofr-03-395\ASCII\NL MinMax : (200nm, 2970nm) Data File : ascii-2- h2o_ice_gds136.9052.asc | |

Sea Water Material Data

| MPRD_ID : Liquid_Water_Sea | | | | CLASS : | Liquid | |
|----------------------------|-----------------------|---------------|---|------------|------------|---------------------|
| | | | | SUBCLASS : | Water | |
| | | | | DATE : | 2005-06-14 | |
| Property Name | Data Source | Specimen Name | Data (qualifier) [parameter] | | | Unit |
| thermal conductivity | US Coast Guard manual | | 0.561,0.57,0.578,0.587,0.596,0.604,0.613,0.622 | | | W/m- watt per meter |
| p-thermal_conductivity | ds-US_CoastGuard | | pa-testTempF [test Temperature (F) : 30,40,50,60,70,80,90,100F] | | | K Kelvin |
| specific heat capacity | US Coast Guard manual | | 3919,3915,3911,3902,3898,3894,3885,3881 | | | J/kg- joule per |
| p-special_heat_capacity | ds-US_CoastGuard | | pa-testTempF [test Temperature (F) : 30,40,50,60,70,80,90,100F] | | | K kilogram Kelvin |

density
p-density

US Coast
Guard manual
ds-US_CoastGuard

1029,1028,1028,1027,1026,1024,1022,1020
pa-testTempF [test Temperature (F) : 30,40,50,60,70,80,90,100F]

kg/m³ kilogram per
cubic meter

reflectance
p-reflectance

USGS Digital Seawater_Open_Ocean
Spectral SW2 lwch
Library sp-sea1
ds-USGS

Path : local-usgs-L- ..\MPRD_DATA\pubs.usgs.gov\of\2003\ofr-03-395\ASCII\I
MinMax : (200nm, 2970nm)
Data File : ascii-2- seawater_open_ocean_sw2.9455.asc

Local Dictionary

MPRD Dictionary

Global MPRD Dictionary : ../MPRD_Dictionary/MPRD_Dictionary.xml

Local MPRD Dictionary :

| Specimen | Authority | Description | Location |
|--|---|--|---|
| H2O-Ice GDS136 sp-distilled-ice1 | USGS Digital Spectral LIBRARY auth-USGS | solid The sample was created by growing ice on a 77K cold finger from water vapor from triply distilled H2O from Gary Olhoeft's lab, USGS, Denver. The sample should have very little contaminants; being essentially pure H2O. | |
| Seawater_Open_Ocean SW2 lwch sp-sea1 | USGS Digital Spectral LIBRARY auth-USGS | liquid Seawater, Atlantic ocean; Marine Light Mixed Layer, sta. G3 , 8-16-91 (August 16, 1991), 1400 local time (1500Z) Lat: 59 27 N Long: 21 12 W. | Oceans Atlantic Ocean Lat: 59 deg 27 min + Long: 21 deg 12 min + |
| DataPath id | Type | Data Path | |
| local-usgs-L | local | ..\MPRD_DATA\pubs.usgs.gov\of\2003\ofr-03-395\ASCII\I | |

3.3 MPRD Global Dictionary

MPRD Global Dictionary is a XML file that is referenced by all MPRD XML material files. The Global Dictionary defines parameters and ids that are global in scope.

MPRD Dictionary

MPRD Dictionary contains definitions of global ids used for MPRD library.

GOVERNMENT CONTACT : NAVAIR Orlando

LICENSE TYPE :

LICENSE RESTRICTIONS :

CLASSIFICATION TYPE : UNCLASS

HANDLING CAVEAT :

LAST REVISED : 2006-09-01

Authority Details

| Authority | Notes |
|--|--|
| auth-ArmyTEC U.S. Army Topographic Engineering Center, Hypermedia Terrain Database (HTD) | The Hypermedia Terrain Database is a hypermedia database of desert landforms. The database contains: airphoto, ground-based, LANDSAT and panoramic imagery; anaglyphs; fly-overs; video; spectral data; and text. This data is organized in a desert landform hierarchy. |
| auth-FEIS FEIS | Fire Effects Information System (USDA forest service). |
| auth-MPRD MPRD | NAVAIR Portable Source Initiative and NAWC-AD Manned Flight Simulator under the NPSI Program and the NAVAIR AWTD Joint IPT efforts. |
| auth-NRCS NRCS | National Resources Conservation Service. |
| auth-USGS USGS Digital Spectral LIBRARY | Splib05a contains 800+ spectra of minerals, mixtures, artificial, liquids and volatiles and vegetation, each with documentation. |

Data Source Details

| DataSource | Type | Public Domain | Notes |
|--|---------------------------------|---------------|---|
| ds-ArmyTEC US Army TEC (Topographic Engineering Center) | government source | true | http://www.tec.army.mil/research/products/desert_guide/l spectra/l spec1.htm |
| ds-NRCS NRCS Soil mart | government source | true | http://soildatamart.nrcs.usda.gov/Default.aspx |
| ds-simetric simetric | internet engineering references | true | http://www.simetric.co.uk/si_materials.htm |
| ds-US_CoastGuard US Coast Guard manual | government source | true | http://www.chrismanual.com/Intro/prop.htm |
| ds-USGS USGS Digital Spectral Library | government source | true | http://pubs.usgs.gov/of/2003/ofr-03-395/datatable.html |

Source Details

| Source | Type | Notes |
|----------------------------|-------------------|---|
| s-AFRL AFRL-MESA | Government Source | AFRL Mesa provides this data under NAVAIR AWTD Joint IPT Program. |

Parameter Details

| Parameter | Units | Notes |
|---|------------------------|-------|
| pa-color color code | | |
| pa-soil_depth Soil depth | in inch | |
| pa-soil_moisture Moisture Content | % percent | |
| pa-testFreq test Frequency | Hz Hertz | |
| pa-testTempC test Temperature (C) | C degree Celsius | |
| pa-testTempF test Temperature (F) | F degree Fahrenheit | |

Property Details

| Property | Type | Units | Notes |
|--|------------|--------------------------------------|---|
| p-CaCO₃ Calcium Carbonate in soil | chemical | % percent | The quantity of Carbonate (CO ₃) in the soil expressed as CaCO ₃ and as a weight percentage of the less than 2 mm size fraction. |
| p-pH pH | chemical | | A measure of soil exchangeable hydrogen ions that may become active by cation exchange. |
| p-salinity soil salinity | chemical | mmhos/cm millimhos per centimeter | The electrical conductivity of an extract from saturated soil paste. |
| p-dielectric_constant dielectric constant | electrical | | The ratio of the capacity of a condenser with that substance as dielectric to the capacity of the same condenser with a vacuum for dielectric. |
| p-dielectric_strength dielectric strength | electrical | v/mil volts per mil | The voltage which an insulating material can withstand before breakdown occurs. |

| | | | |
|---|------------|--|---|
| p-electrical_conductivity electrical conductivity | electrical | mho/m | The ability of a material to conduct electricity. |
| p-electrical_resistivity electrical resistivity | electrical | ohm-m | The property of a material that resists the flow of electrical current. |
| p-magnetic_susceptibility magnetic susceptibility | electrical | | The degree to which a material can be magnetized in an external magnetic field. |
| p-elastic_modulus elastic modulus | mechanical | GPa giga pascal MPa mega pascal Pa pascal | The ratio of the applied stress to the change in shape of an elastic body. |
| p-flexible_strength flexible strength | mechanical | GPa giga pascal MPa mega pascal Pa pascal | The strength of a material in bending, expressed as the stress on the outermost fibers of a bent test specimen, at the instant of failure. |
| p-hardness hardness | mechanical | | The property of being rigid and resistant to pressure; not easily scratched. |
| p-modulus_rupture modulus of rupture | mechanical | GPa giga pascal MPa mega pascal Pa pascal | The force necessary to break a specimen of specified width and thickness. |
| p-poisson_ratio poisson's ratio | mechanical | | The ratio of the transverse contracting strain to the longitudinal elongational strain when a tensile stress is applied to a material. |
| p-ultimate_stress ultimate stress | mechanical | GPa giga pascal MPa mega pascal Pa pascal | Ultimate stress often or ultimate strength is the maximum stress that a material can withstand while being stretched or pulled before necking, which is when the specimen's cross-section starts to significantly contract. Tensile strength is the opposite of compressive strength and the values can be quite different. |
| p-viscosity viscosity | mechanical | centipoises poise | A measure of internal friction or the resistance of a fluid flow. |
| p-young_modulus young modulus | mechanical | GPa giga pascal MPa mega pascal Pa pascal | The ratio of normal stress within the proportional limit to the corresponding normal strain. |

| | | | | |
|---|------------|-------------------|--------------------------------------|---|
| p_compressive_strength compressive strength | mechanical | GPa MPa Pa | giga pascal mega pascal pascal | (1) The maximum compressive load (sustained by a specimen during a compression test) divided by the original cross-sectional area. (2) The ability of a material to resist a uniaxial compressive load that tends to crush it. |
| p-clay clay content in soil | physical | % | percent | Clay as a soil separate consists of mineral soil particles that are less than 0.02 millimeter in diameter. The estimated clay content is given as a percentage by weight. |
| p-density density | physical | kg/m ³ | kilogram per cubic meter | The density is defined as a mediums mass per unit volume. |
| p-LAI leaf area index | physical | | | The area of foliage per unit area of ground. Conventionally this refers to the ratio of the area of the upper side of the leaves in a canopy projected onto a flat surface to the area of the surface under the canopy. Occasionally this has been used in reference to both sides of the leaves. |
| p-moisture moisture bulk density in soil | physical | % | percent | Plant and animal residue in the soil at various stages of decomposition. |
| p-organic organic matter in soil | physical | % | percent | Plant and animal residue in the soil at various stages of decomposition. |
| p-permeability permeability | physical | cm/sec | centimeter per second | The ease with which fluids flow through a rock or sediment. |
| p-porosity porosity | physical | % | percent | The amount of pore space in a rock (the spaces between the grains). |
| p-sand sand content in soil | physical | % | percent | Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeter in diameter. The estimated sand content is given as a percentage by weight. |
| p-silt silt content in soil | physical | % | percent | Sand as a soil separate consists of mineral soil particles that are 0.002 millimeter to 0.05 millimeter in diameter. The estimated silt content is given as a percentage by weight. |
| p-special_gravity specific gravity | physical | | | The ratio of the weight of a particular volume of a given substance to the weight of an equal volume of pure water. |
| p-VI vegetation index | physical | | | The reduction of multispectral scanning measurements to a single value for predicting and assessing vegetative characteristics such as plant leaf area, total biomass and general plant stress and vigor. |

| | | | | |
|--|---------|---|---------|---|
| p-color_x CIE chromaticity x coordinate | surface | | | In the CIE Yxy color space, x represents the red component of the perceived color. |
| p-color_y CIE chromaticity y coordinate | surface | | | In the CIE Yxy color space, y represents the green component of the perceived color. |
| p-color_Y_D65 CIE chromaticity brightness parameter Y | surface | | | In the CIE Yxy color space, Y provides the brightness function of the perceived color. |
| p-reflectance reflectance | surface | % | percent | The fraction or percent of a particular frequency or wavelength of electromagnetic radiation that is reflected from the surface of a substance without being absorbed or transmitted. |
| p-reflectance-VIS reflectance in Visible band 410-722 nm | surface | % | percent | The fraction or percent of a particular frequency or wavelength of electromagnetic radiation that is reflected from the surface of a substance without being absorbed or transmitted. |
| p-reflectance_BDR bi-directional directional reflectance | surface | % | percent | Reflectance as a function of reflectance angle in the plane of illuminating source for each incidence angle for which SDR data are measured. These data are provided in three spectral bands (visible, 3-5µm, and 8-12µm) from which the lobe width of the specular lobe can be determined. |
| p-reflectance_DDR diffuse directional reflectance | surface | % | percent | Hemispherical reflectance for specific angles of incidence of the illuminating source with the specular component blocked (+1/2 degree from the specular angle). |
| p-reflectance_HDR hemispherical directional reflectance | surface | % | percent | Hemispherical reflectance for specific angles of incidence of the illuminating source. |
| p-reflectance_NIR reflectance in NIR band 724-2500 nm | surface | % | percent | The fraction or percent of a particular frequency or wavelength of electromagnetic radiation that is reflected from the surface of a substance without being absorbed or transmitted. |
| p-reflectance_SDR specular directional reflectance | surface | % | percent | Specular reflectance component for specific angles of incidence of the illuminating source, computed by subtracting HDR and DDR. |

| | | | | |
|---|---------|--------|---------------------------|--|
| p-reflectance_solar reflectance in solar band 300-2500 nm | surface | % | percent | The fraction or percent of a particular frequency or wavelength of electromagnetic radiation that is reflected from the surface of a substance without being absorbed or transmitted. |
| p-reflectance_SRI Solar Reflectance Index | surface | | | The Solar Reflectance Index (SRI.) is a measure of a material's ability to reject solar heat, as shown by a small temperature rise. It is defined so that a standard black (reflectance 0.05, emittance 0.90) is 0 and a standard white (reflectance 0.80, emittance 0.90) is 100. For example, the standard black has a temperature rise of 90 deg. F (50 deg. C) in full sun, and the standard white has a temperature rise of 14.6 deg. F (8.1 deg. C). Once the maximum temperature rise of a given material has been computed, the SRI can be computed by interpolating between the values for white and black. |
| p-reflectance_THR total hemispherical reflectance | surface | % | percent | Total reflectance for a near-normal angle of incidence (7 or 10 degrees) of illuminating source. |
| p-reflectance_UV reflectance in UV band 300-400 nm | surface | % | percent | The fraction or percent of a particular frequency or wavelength of electromagnetic radiation that is reflected from the surface of a substance without being absorbed or transmitted. |
| p-infrared_emittance infrared emittance | thermal | | | Infrared Emittance is a parameter between 0 and 1 that measures the ability of a warm or hot material to shed some of its heat in the form of infrared radiation. The wavelength range for this radiant energy is roughly 5 to 40 micrometers. |
| p-special_heat_capacity specific heat capacity | thermal | J/kg-K | joule per kilogram Kelvin | This is the amount of heat (in calories or Joules) that must be added or removed from a unit mass of that substance to change its temperature by one degree |
| p-thermal_conductivity thermal conductivity | thermal | W/m-K | watt per meter Kelvin | The property of a material that describes the rate at which heat will be conducted through a unit area of the material for a given period of time. |
| p-thermal_radiation thermal radiation emissivity coefficient | thermal | | | The ratio of the radiation emitted by a surface to that emitted by a black body at the same temperature. |

Data File Format Details

| Data File Format | Headings | Columns | Notes |
|------------------|--|--|-------|
| ascii-1 | delimiter: , header to skip: 5 | Labels: Wavelength, Reflectance Units: nm,% Formats: float, float | |
| ascii-2 | delimiter: SPACE header to skip: 14 | Labels: Wavelength, Reflectance, Standard Deviation Units: um, %, % Formats: float, float, float | |
| ascii-3 | delimiter: SPACE header to skip: 26 | Labels: Wavelength, Reflectance Units: um, % Formats: float, float | |
| ascii-4 | delimiter: SPACE header to skip: 0 | Labels: Wavelength, Reflectance Units: um, % Formats: float, float | |

Data Table Details

| Table Format | # of columns | Columns |
|--------------|--------------|--|
| tbl1 | 2 | Labels: wavelength, reflectance Units: um, % Formats: float, float |

4. Organization of the Standard

The metadata standard is defined in a schema file based on World Wide Web Consortium (W3C) XML format (<http://www.w3.org/2001/XMLSchema>) and is available separately from this document in XSD file format. The filename of the schema is:

MPRD.2.2.xx.xsd, where xx = minor file revision

The schema hard copy is reported in the following sections and organized into:

MPRD_Doc

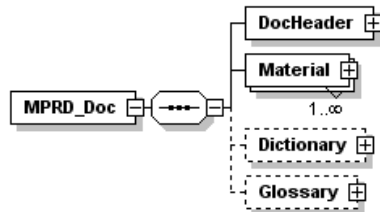
MPRD_Doc Complex Types (alphabetical)

MPRD_Doc Simple Types (alphabetical)

MPRD_Dictionary_Doc

MPRD_Dictionary_Doc Complex Types (alphabetical)

MPRD_Doc is the root element of the MPRD XML document. Its child elements are grouped as follows:



DocHeader is the document header containing document title, revision history, and other administrative information (contact info, licensing, security, etc.)

Material element contains the material definitions, such as MPRD_ID, material property data (*BulkDetails*), and component details. One *MPRD_Doc* may contain one or many *Material* elements. *ComponentDetails* is an optional element and can be used for complex/composite materials.

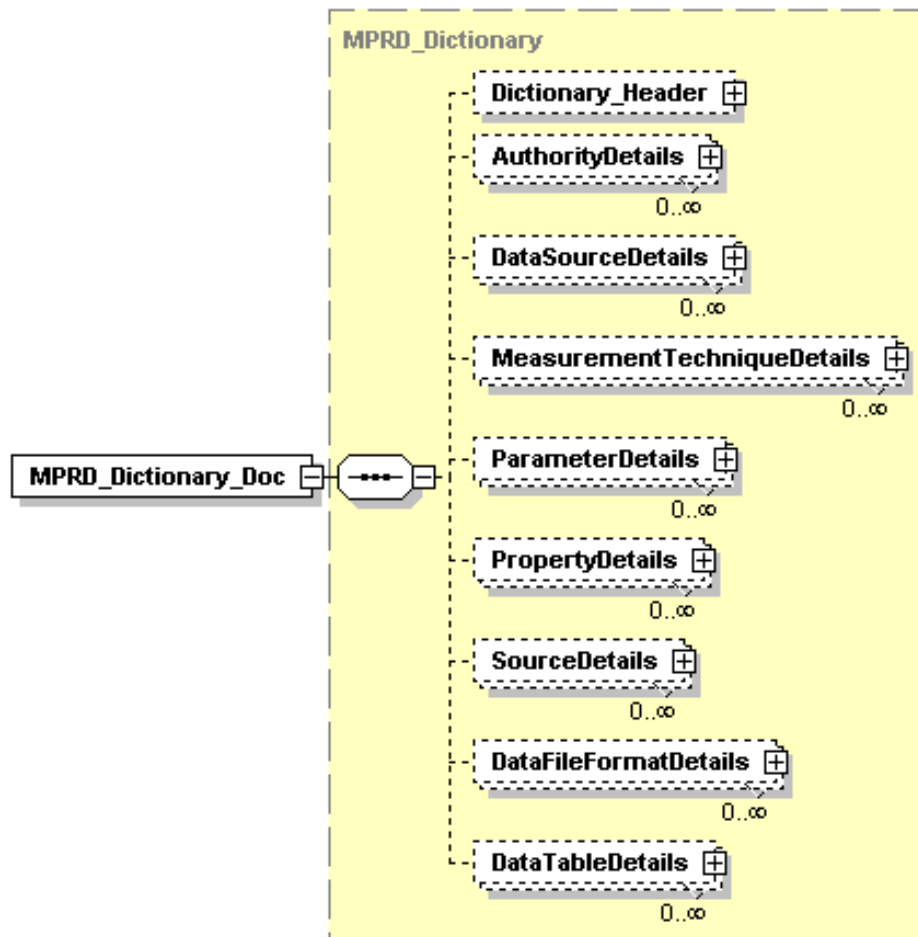
Dictionary element is a local definition of "id"s attribute that are valid for this document only. For "ids" attribute that are valid for *all* MPRD documents, the definition would be stored in a global dictionary *MPRD_Dictionary* document.

Glossary is a collection of definition of terms that are used in this XML document.

MPRD_Doc Complex Types list all of the complex-types used in *MPRD_Doc*. A complex type is a typical complex element that may be used in multiple instances of elements. A complex element is an element having child element(s). The list is alphabetical and not grouped into logical application.

MPRD_Doc Simple Types list all of the simple-types used by in *MPRD_Doc*. A simple type is a typical simple element that may be used in multiple instances of elements. A simple element is an element without a child. A simple element may contain an enumeration of valid data entry. The list is alphabetical and not grouped into logical application.

MPRD_Dictionary_Doc is the root element of the global MPRD Dictionary XML document. Its child elements are grouped as follows:



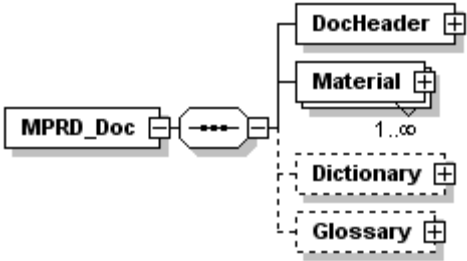
MPRD_Dictionary_Doc Complex Types list all of the complex-types used in *MPRD_Dictionary_Doc* in alphabetical order.

Appendix A MPRD Schema in a pictorial detailed description

A.1 MPRD Doc Elements

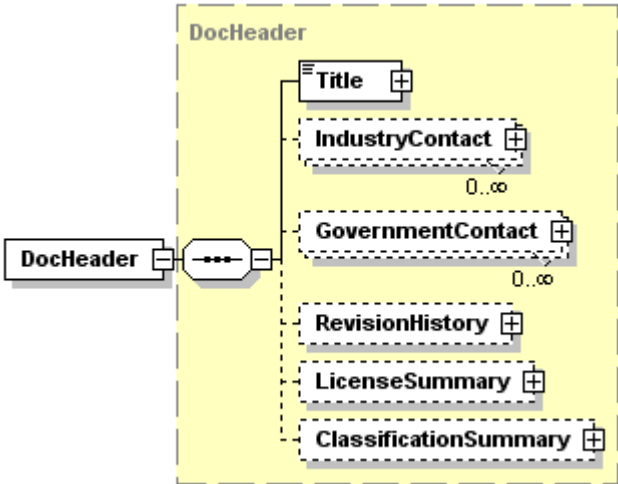
A.1.1 Document Root: MPRD Doc

element **MPRD_Doc**

| | |
|------------|---|
| diagram |  |
| annotation | MPRD document root. |

A.1.2 DocHeader

element **MPRD_Doc/DocHeader**

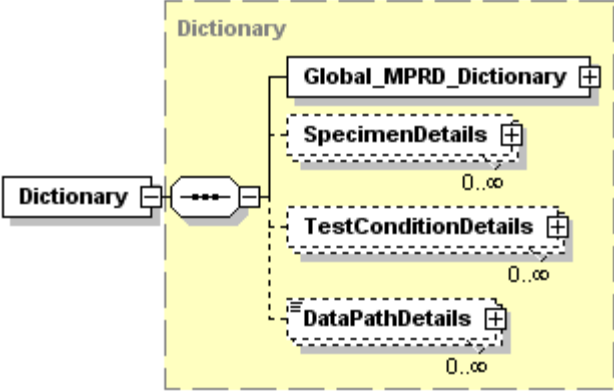
| | |
|------------|--|
| diagram |  |
| type | DocHeader |
| annotation | DocHeader contains MPRD_Doc administrative information. |

A.1.3 Materialelement **MPRD_Doc/Material**

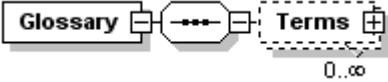
| | | | | | |
|------------|--|-------------|----------|--|--|
| diagram | | | | | |
| type | Material | | | | |
| attributes | Name | Type | Use | Annotation | |
| | MPRD_ID | | required | attribute: human readable unique ID that identify the material using the following rule: [Class]_[Subclass]_[Name] [Name] is the same as the Bulk_Name element under BulkDetails. [Class] is the same as the Class element under BulkDetails. [Subclass] is the same as the Subclass element under BulkDetails. Examples: - Vegetation_Tree_Sierra Lodgepole Pine - Liquid_Water_Distilled - Construction_Roof_Red Concrete Tile | |
| | id | xsd:ID | optional | attribute: a unique sequential index or a computer generated globally unique identification (GUID). This id will be used in managing the material database. | |
| | date | xsd:string | optional | attribute: the date the material is last updated. | |
| | layers | xsd:integer | optional | attribute: may be used to indicate the number of layers in complex systems such as composite laminates. | |
| | local_frame_of_reference | xsd:string | optional | attribute: may be used as an identification specifier for the local material orientation relative to the global frame of reference, which is especially useful for complex systems such as anisotropic materials. | |
| annotation | Material element contains MPRD_Doc material definitions. | | | | |

A.1.4 Dictionary

element **MPRD_Doc/Dictionary**

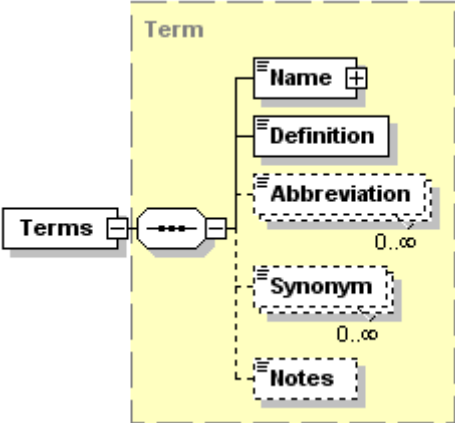
| | |
|------------|--|
| diagram |  <p>The diagram shows a 'Dictionary' element (solid rectangle) connected to a container (dashed rectangle) labeled 'Dictionary'. Inside this container are four sub-elements: 'Global_MPRD_Dictionary' (solid rectangle), 'SpecimenDetails' (dashed rectangle), 'TestConditionDetails' (dashed rectangle), and 'DataPathDetails' (dashed rectangle). Each sub-element has a multiplicity of '0..∞'.</p> |
| type | Dictionary |
| annotation | Dictionary element contains local data dictionary and location of external global data dictionary. The dictionaries contain details describing ids used in MPRD_Doc. |

element **MPRD_Doc/Glossary**

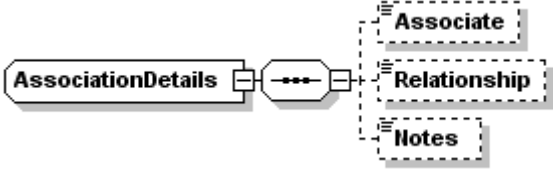
| | |
|------------|--|
| diagram |  <p>The diagram shows a 'Glossary' element (solid rectangle) connected to a 'Terms' element (dashed rectangle). The 'Terms' element has a multiplicity of '0..∞'.</p> |
| annotation | Glossary contains descriptions of material and property terms used in MPRD_Doc. |

A.1.5 Glossary


element **MPRD_Doc/Glossary/Terms**

| | |
|---------|---|
| diagram |  <p>The diagram shows a 'Terms' element (solid rectangle) connected to a container (dashed rectangle) labeled 'Term'. Inside this container are five sub-elements: 'Name' (solid rectangle), 'Definition' (solid rectangle), 'Abbreviation' (dashed rectangle), 'Synonym' (dashed rectangle), and 'Notes' (dashed rectangle). The 'Abbreviation' and 'Synonym' elements have a multiplicity of '0..∞'.</p> |
| type | Term. |


A.2 MPRD Doc Complex Types (Alphabetical)A.2.1 AssociationDetailscomplexType **AssociationDetails**

| | |
|------------|--|
| diagram |  |
| used by | element ComponentDetails/AssociationDetails |
| annotation | Complex-type: containing a description of a relationship of the component to another component in a complex material system such as a composite, weld, or multilayer material. |


element **AssociationDetails/Associate**

| | |
|------------|---|
| diagram |  |
| type | xsd:IDREF |
| annotation | Associate contains the id of the associated component. |

element **AssociationDetails/Relationship**

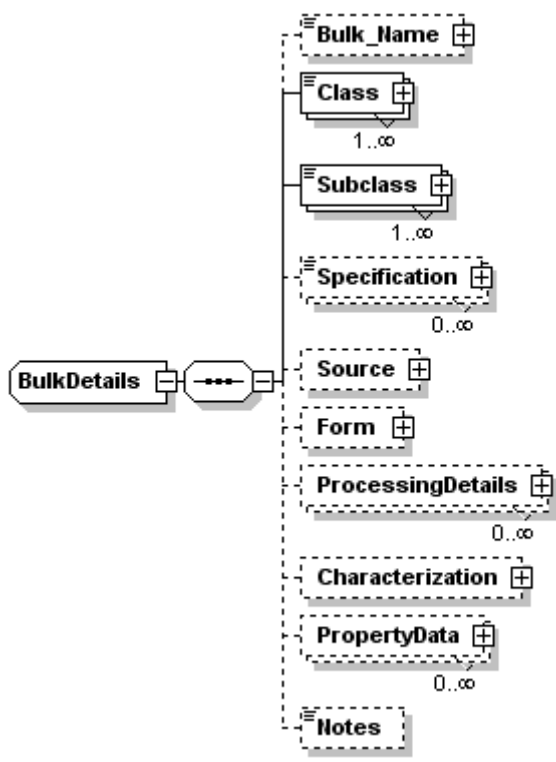
| | |
|------------|---|
| diagram |  |
| type | xsd:string |
| annotation | Relationship contains a description of the relationship between a component and the associate. For example, in a metal roof, the paint material will be associated with the "base" as the "coating" of the "base material". |

element **AssociationDetails/Notes**

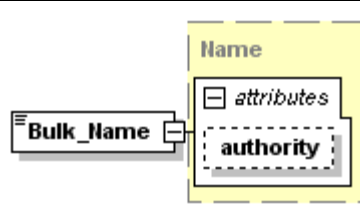
| | |
|------------|---|
| diagram |  |
| type | Notes |
| annotation | Notes element contains any additional information concerning the association. |

A.2.2 BulkDetails

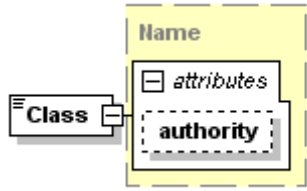
complexType BulkDetails

| | |
|------------|--|
| diagram |  <p>The diagram shows the structure of the BulkDetails complex type. It is a container for several child elements: Bulk_Name (required, 1..1), Class (optional, 1..∞), Subclass (optional, 1..∞), Specification (optional, 0..∞), Source (optional, 0..∞), Form (optional, 0..∞), ProcessingDetails (optional, 0..∞), Characterization (optional, 0..∞), PropertyData (optional, 0..∞), and Notes (optional, 0..∞). The BulkDetails element is shown as a rounded rectangle with a dashed line indicating its content.</p> |
| used by | element Material/BulkDetails |
| annotation | Complex-type: containing bulk material information. |

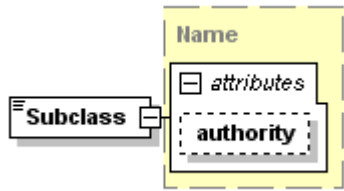
element BulkDetails/Bulk_Name

| diagram |  | | | | | | | | | | | |
|------------|---|----------|--|-----|------------|-----------|------------|----------|--|--|--|--|
| type | Name | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | | | | | | | |
| annotation | The material name as assigned by the authoritative source defined in the authority attribute. Example: <Bulk_Name authority="Auth1">Sierra Lodgepole Pine</Bulk_Name> | | | | | | | | | | | |

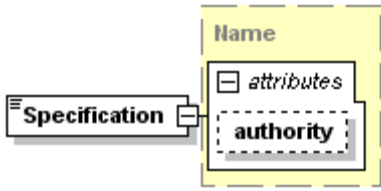
element **BulkDetails/Class**

| diagram |  | | | | | | | | | | |
|------------|--|----------|--|-----|------------|-----------|------------|----------|--|--|--|
| type | Name | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary. | | |
| Name | Type | Use | Annotation | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary. | | | | | | | | |
| annotation | <p>The material class to which the bulk material belongs. The Class name is defined by the authoritative source.</p> <p>Examples for Class names:</p> <ul style="list-style-type: none">- Rock- Soil- Vegetation <p>The xml format:</p> <pre><Class authority="Auth1">Rock</Class></pre> | | | | | | | | | | |

element **BulkDetails/Subclass**

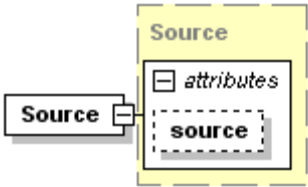
| diagram |  | | | | | | | | | | | |
|------------|--|----------|--|-----|------------|-----------|------------|----------|--|--|--|--|
| type | Name | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary. | | | | | | | | | |
| annotation | <p>The material subclass to which the bulk material belongs. The subclass is name is defined by the authoritative source.</p> <p>Example subclass names for Vegetation material class:</p> <ul style="list-style-type: none">- Shrub- Tree- Cactus <p>The xml format:</p> <pre><Subclass authority="Auth1">Tree</Subclass></pre> | | | | | | | | | | | |

element **BulkDetails/Specification**

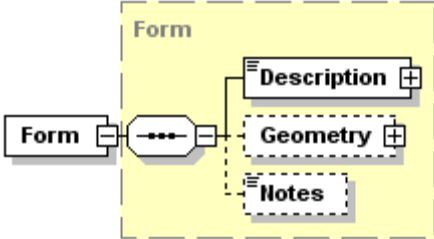
| | | | | |
|---------|---|--|--|--|
| diagram |  | | | |
| type | Name | | | |

| | | | | |
|------------|---|---------------------------|-----------------|--|
| attributes | Name authority | Type xsd:string | Use optional | Annotation attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. |
| annotation | documentation The material specification code assigned under the authoritative source. Example Specification for Sierra Lodgepole Pine: Pinus contorta var. murrayana (latin name, defined under authority FEIS (Fire Effects Information System (USDA forest service)) The xml format: <Specification authority="Auth6">Pinus contorta var. murrayana</Specification> | | | |

element **BulkDetails/Source**

| | | | | |
|------------|---|---------------------------|-----------------|--|
| diagram |  | | | |
| type | Source | | | |
| attributes | Name source | Type xsd:string | Use optional | Annotation attribute: source id as defined in SourceDetails section of MPRD_Dictionary. |
| annotation | The source provider of data. Example: <Source source="s2"/> | | | |

element **BulkDetails/Form**

| | | | | |
|------------|--|--|--|--|
| diagram |  | | | |
| type | Form | | | |
| annotation | Form element describes the form of the bulk material. It includes a description string and a complex element Geometry to describe shape, dimensions and orientation. | | | |

element **BulkDetails/ProcessingDetails**

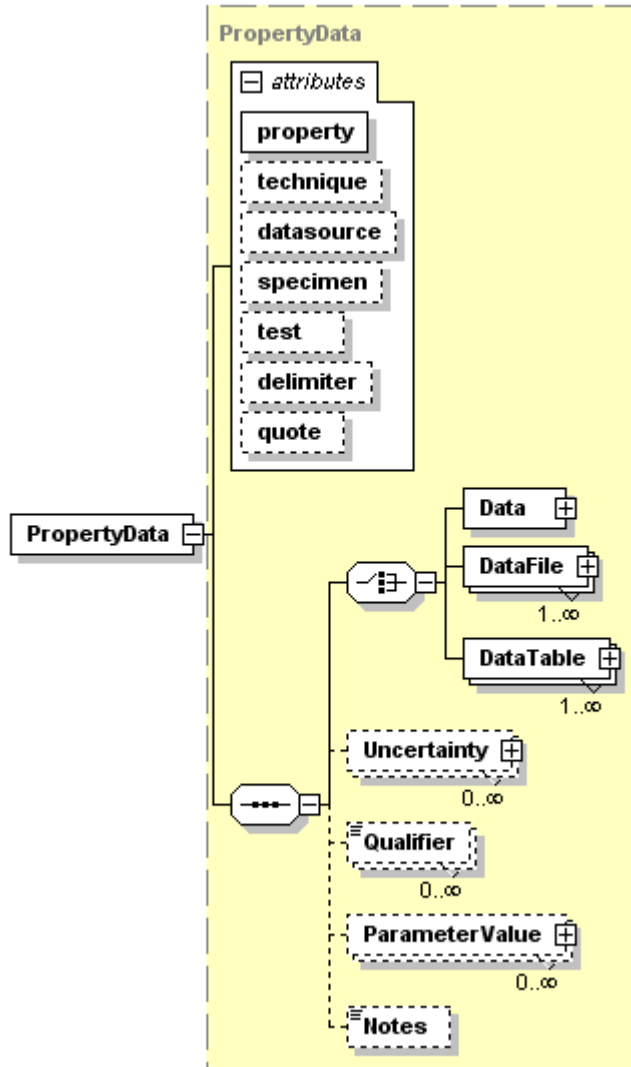
| | |
|------------|--|
| diagram | |
| type | ProcessingDetails |
| annotation | ProcessingDetails element contains information of the parameters under which the bulk material is being processed. Examples are the testing temperature, pressure. |

element **BulkDetails/Characterization**

| | |
|------------|---|
| diagram | |
| type | Characterization |
| annotation | Characterization element describes the chemical composition of the bulk material. |

element **BulkDetails/PropertyData**

diagram



type

extension of **PropertyData**

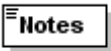
attributes

| Name | Type | Use | Annotation |
|------------|------------|----------|---|
| property | xsd:string | required | attribute: property data id as defined in PropertyDetails section of MPRD_Dictionary. |
| technique | xsd:string | | attribute: technique id as defined in MeasurementTechniqueDetails section of MPRD_Dictionary. |
| datasource | xsd:string | | attribute: data source id as defined in DataSourceDetails section of MPRD_Dictionary. |
| specimen | xsd:string | | attribute: specimen id as defined in SpecimenDetails in the Dictionary element. |
| test | xsd:string | | attribute: test condition id as defined in TestConditionDetails in Metadata. |
| delimiter | | | attribute: delimiter specifies the delimiter that separates multiple values in the Data, Qualifier, Uncertainty, and ParameterValue elements. The default value is a comma (','). |
| quote | xsd:string | | attribute: quote specifies the string that is used to quote values in the Data, Qualifier, Uncertainty and ParameterValue elements. |

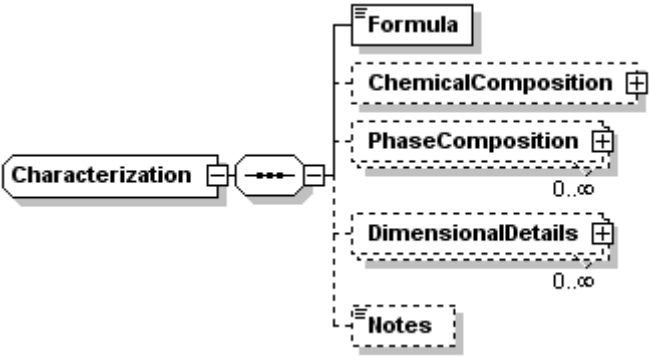
annotation

PropertyData element contains property data for the bulk material. The propertydata includes physical, chemical, mechanical, thermal and electrical data.
 Note -Multiple entries in the Data, Qualifier, Uncertainty Value, and ParameterValue elements must be comma delimited and synchronized across elements, i.e., the number of entries in each of these four elements must be equal.


element **BulkDetails/Notes**

| | |
|---------|---|
| diagram |  |
| type | Notes |


A.2.3 CharacterizationcomplexType **Characterization**

| | |
|------------|---|
| diagram |  |
| used by | elements BulkDetails/Characterization ComponentDetails/Characterization |
| annotation | Complex-type: containing a description of the chemical composition of the bulk material or component. |

element **Characterization/Formula**

| | |
|------------|--|
| diagram |  |
| type | Formula |
| annotation | Formula contains a string representation of the chemical formula for the bulk material or component. |

element **Characterization/ChemicalComposition**

| | |
|------------|--|
| diagram |  |
| type | ChemicalComposition |
| annotation | ChemicalComposition contains a description of the compounds and elements that comprise the bulk material or component. |

element **Characterization/PhaseComposition**

| | |
|------------|---|
| diagram | |
| type | PhaseComposition |
| annotation | PhaseComposition contains a description of the phases that comprise the bulk material or component. |

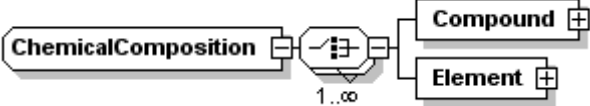
element **Characterization/DimensionalDetails**

| | |
|------------|--|
| diagram | |
| type | DimensionalDetails |
| annotation | DimensionalDetails contains information relating to component or bulk material dimensional characteristics such as grain size, porosity, precipitate size and distribution, etc. |

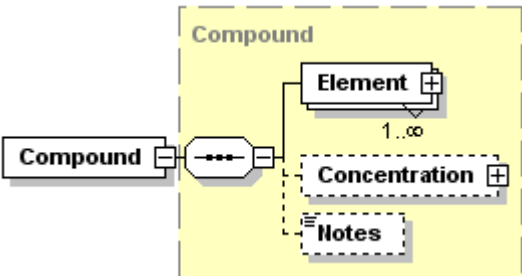
element **Characterization/Notes**

| | |
|------------|--|
| diagram | |
| type | Notes |
| annotation | Notes contains any additional information concerning the Characterization. |

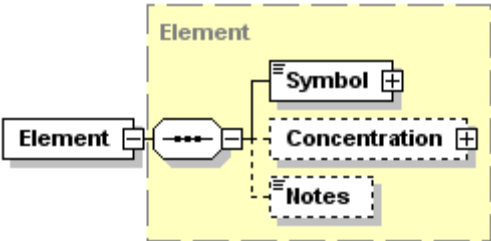
A.2.4 ChemicalCompositioncomplexType **ChemicalComposition**

| | |
|------------|---|
| diagram |  The diagram shows a box labeled 'ChemicalComposition' connected to a container box. Inside the container box, there are two sub-boxes: 'Compound' and 'Element'. The 'Element' box has a multiplicity of '1..∞' next to it. |
| used by | element Characterization/ChemicalComposition |
| annotation | Complex-type: containing a detailed description of the compounds and elements that comprise the bulk material or component. |

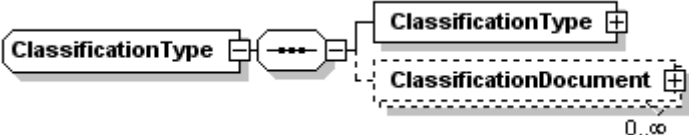
element **ChemicalComposition/Compound**

| | |
|------------|---|
| diagram |  The diagram shows a box labeled 'Compound' connected to a container box. Inside the container box, there are three sub-boxes: 'Element', 'Concentration', and 'Notes'. The 'Element' box has a multiplicity of '1..∞' next to it. The entire container box is highlighted with a yellow background. |
| type | Compound |
| annotation | Compound contains a description of a compound. |

element **ChemicalComposition/Element**

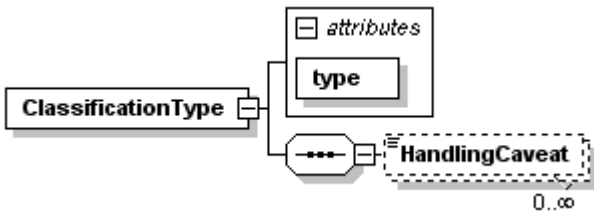
| | |
|------------|---|
| diagram |  The diagram shows a box labeled 'Element' connected to a container box. Inside the container box, there are three sub-boxes: 'Symbol', 'Concentration', and 'Notes'. The 'Concentration' box has a multiplicity of '1..∞' next to it. The entire container box is highlighted with a yellow background. |
| type | Element |
| annotation | Element contains chemical element symbols and concentrations. |

A.2.5 ClassificationTypecomplexType **ClassificationType**


| | |
|---------|---|
| diagram |  The diagram shows a box labeled 'ClassificationType' connected to a container box. Inside the container box, there are two sub-boxes: 'ClassificationType' and 'ClassificationDocument'. The 'ClassificationDocument' box has a multiplicity of '0..∞' next to it. |
| used by | element DocHeader/ClassificationSummary |

| | |
|------------|--|
| annotation | Complex-type: containing handling restrictions imposed on the overall dataset or each data file for national security, privacy, or other concerns. |
|------------|--|

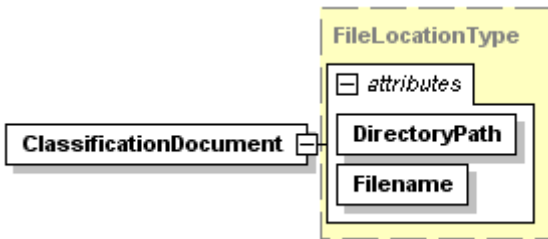
element **ClassificationType/ClassificationType**

| diagram |  | | | | | | | | | | | |
|------------|--|----------|------------------------------------|-----|------------|------|--|----------|------------------------------------|--|--|--|
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>type</td><td></td><td>required</td><td>Name of the handling restrictions.</td></tr></table> | Name | Type | Use | Annotation | type | | required | Name of the handling restrictions. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| type | | required | Name of the handling restrictions. | | | | | | | | | |

element **ClassificationType/ClassificationType/HandlingCaveat**

| | | | |
|------------|---|--------|--|
| diagram |  | | |
| type | restriction of xsd:string | | |
| facets | enumeration | FOUO | |
| | enumeration | CNWDR | |
| | enumeration | LIMDIS | |
| annotation | Additional information about the handling restrictions. | | |

element **ClassificationType/ClassificationDocument**

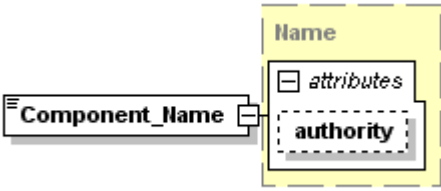
| | | | | |
|------------|---|------------|----------|---|
| diagram |  | | | |
| type | FileLocationType | | | |
| attributes | Name | Type | Use | Annotation |
| | DirectoryPath | xsd:string | required | Path to the file location. This could be URL, relative, or absolute path. |
| | Filename | xsd:string | required | Filename with extension. |

A.2.6 ComponentDetails

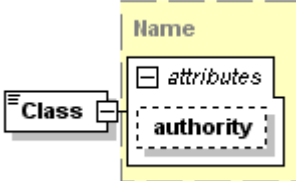
complexType **ComponentDetails**

| diagram | | | | | | | | | | | | |
|------------|---|---|---|-----|------------|----|--------|----------|---|--|--|--|
| used by | elements | ComponentDetails/ComponentDetails Material/ComponentDetails | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>optional</td><td>attribute: id is used in AssociationDetails element. The component id can be paired with other components with relationships defined in Relationship element.</td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | optional | attribute: id is used in AssociationDetails element. The component id can be paired with other components with relationships defined in Relationship element. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| id | xsd:ID | optional | attribute: id is used in AssociationDetails element. The component id can be paired with other components with relationships defined in Relationship element. | | | | | | | | | |
| annotation | Complex-type: containing description of components within the bulk material and has one optional attribute, id, which may be used as an identification specifier for the component and is especially useful for complex systems such as composite laminates. | | | | | | | | | | | |

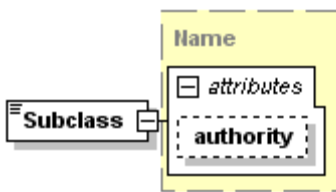
element **ComponentDetails/Component_Name**

| diagram |  | | | | | | | | | | | |
|------------|---|----------|--|-----|------------|-----------|------------|----------|--|--|--|--|
| type | Name | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | | | | | | | |
| annotation | The material name as assigned by the authoritative source defined in the authority attribute. Example: Asphalt aggregate. | | | | | | | | | | | |

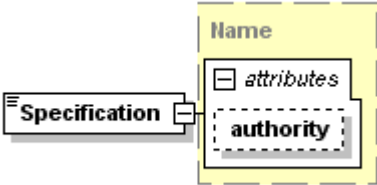
element **ComponentDetails/Class**

| diagram |  | | | | | | | | | | | |
|------------|---|----------|--|-----|------------|-----------|------------|----------|--|--|--|--|
| type | Name | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | | | | | | | |
| annotation | <p>The material class to which the component material belongs. The Class name is defined by the authoritative source.</p> <p>Examples for Class names:</p> <ul style="list-style-type: none">- Rock- Soil- Vegetation | | | | | | | | | | | |

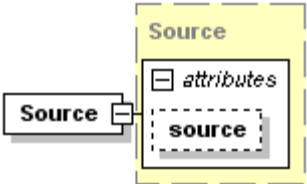
element **ComponentDetails/Subclass**

| diagram |  | | | | | | | | | | | |
|------------|---|----------|--|-----|------------|-----------|------------|----------|--|--|--|--|
| type | Name | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | | | | | | | |
| annotation | <p>The material subclass to which the component material belongs. The subclass is name is defined by the authoritative source.</p> <p>Example subclass Names for Vegetation material class:</p> <ul style="list-style-type: none">- Shrub- Tree- Cactus | | | | | | | | | | | |

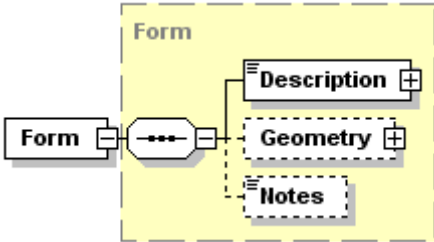
element **ComponentDetails/Specification**

| | | | | |
|------------|---|------------|----------|--|
| diagram |  | | | |
| type | Name | | | |
| attributes | Name | Type | Use | Annotation |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. |
| annotation | The material specification code assigned under the authoritative source. | | | |

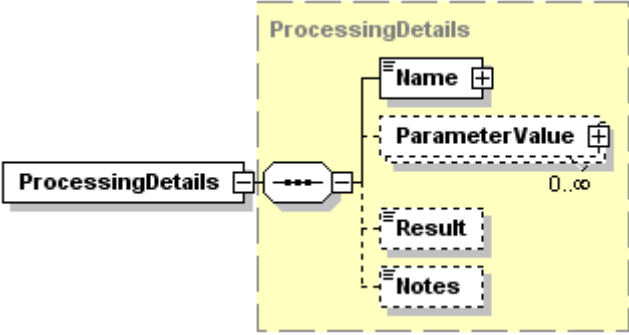
element **ComponentDetails/Source**

| | | | | |
|------------|---|------------|----------|--|
| diagram |  | | | |
| type | Source | | | |
| attributes | Name | Type | Use | Annotation |
| | source | xsd:string | optional | attribute: source id as defined in SourceDetails section of MPRD_Dictionary. |
| annotation | The source provider of data. | | | |

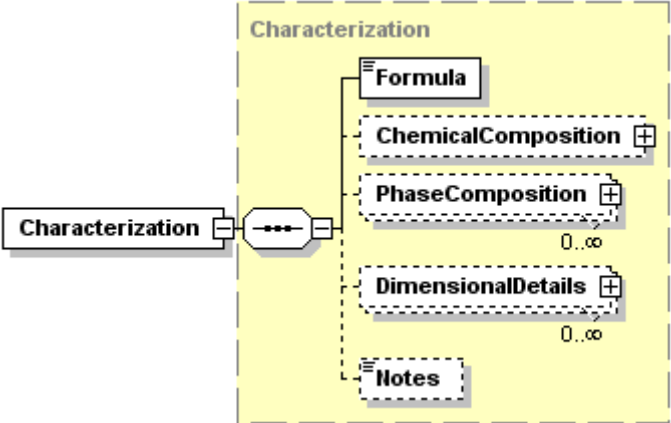
element **ComponentDetails/Form**

| | | | | |
|------------|---|--|--|--|
| diagram |  | | | |
| type | Form | | | |
| annotation | Form element describes the form of the component material. It includes a description string and a complex element Geometry to describe shape, dimensions and orientation. | | | |

element **ComponentDetails/ProcessingDetails**

| | |
|------------|---|
| diagram |  |
| type | ProcessingDetails |
| annotation | ProcessingDetails element contains information of the parameters under which the component material is being processed. Examples are the testing temperature, pressure. |

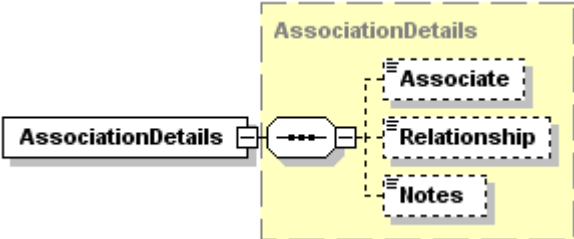
element **ComponentDetails/Characterization**

| | |
|------------|--|
| diagram |  |
| type | Characterization |
| annotation | Characterization element describes the chemical composition of the component material. |

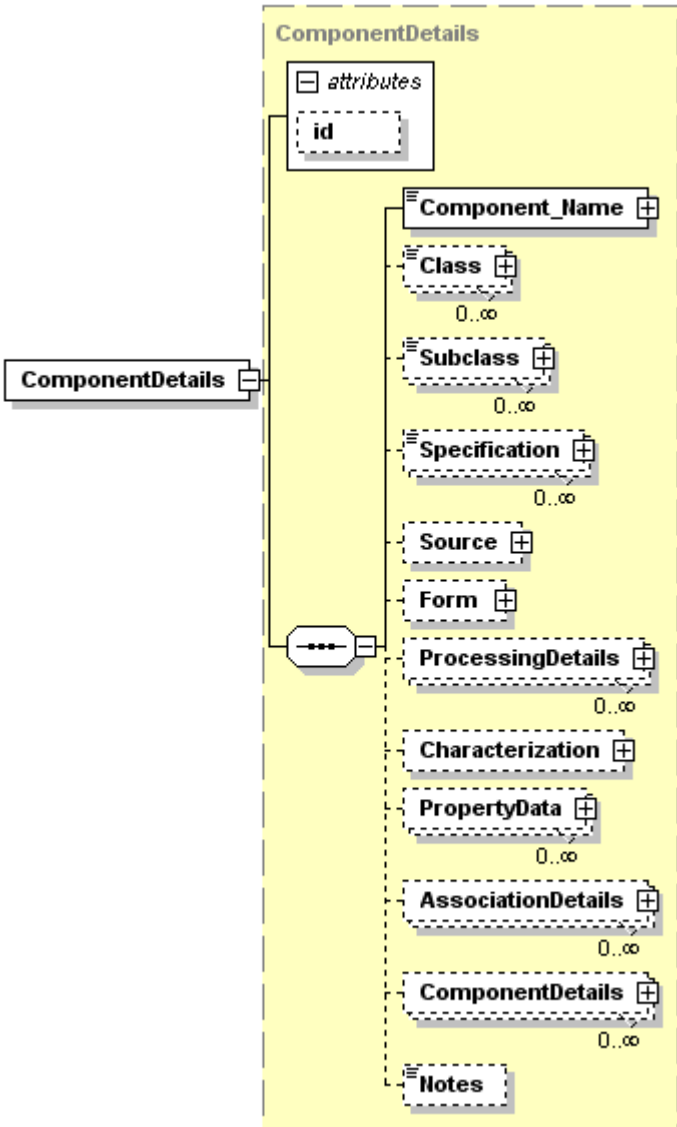
element **ComponentDetails/PropertyData**

| diagram | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------|--|----------|---|-----|------------|----------|------------|----------|--|-----------|------------|--|--|------------|------------|--|--|----------|------------|--|---|------|------------|--|--|-----------|--|--|---|-------|------------|--|---|--|--|
| type | PropertyData | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>property</td><td>xsd:string</td><td>required</td><td>attribute: property data id as defined in PropertyDetails section of MPRD_Dictionary</td></tr><tr><td>technique</td><td>xsd:string</td><td></td><td>attribute: technique id as defined in MeasurementTechniqueDetails section of MPRD_Dictionary</td></tr><tr><td>datasource</td><td>xsd:string</td><td></td><td>attribute: data source id as defined in DataSourceDetails section of MPRD_Dictionary</td></tr><tr><td>specimen</td><td>xsd:string</td><td></td><td>attribute: specimen id as defined in SpecimenDetails in the Dictionary element.</td></tr><tr><td>test</td><td>xsd:string</td><td></td><td>attribute: test condition id as defined in TestConditionDetails in Metadata.</td></tr><tr><td>delimiter</td><td></td><td></td><td>attribute: delimiter specifies the delimiter that separates multiple values in the Data, Qualifier, Uncertainty, and ParameterValue elements. The default value is a comma (',').</td></tr><tr><td>quote</td><td>xsd:string</td><td></td><td>attribute: quote specifies the string that is used to quote values in the Data, Qualifier, Uncertainty and ParameterValue elements.</td></tr></table> | Name | Type | Use | Annotation | property | xsd:string | required | attribute: property data id as defined in PropertyDetails section of MPRD_Dictionary | technique | xsd:string | | attribute: technique id as defined in MeasurementTechniqueDetails section of MPRD_Dictionary | datasource | xsd:string | | attribute: data source id as defined in DataSourceDetails section of MPRD_Dictionary | specimen | xsd:string | | attribute: specimen id as defined in SpecimenDetails in the Dictionary element. | test | xsd:string | | attribute: test condition id as defined in TestConditionDetails in Metadata. | delimiter | | | attribute: delimiter specifies the delimiter that separates multiple values in the Data, Qualifier, Uncertainty, and ParameterValue elements. The default value is a comma (','). | quote | xsd:string | | attribute: quote specifies the string that is used to quote values in the Data, Qualifier, Uncertainty and ParameterValue elements. | | |
| Name | Type | Use | Annotation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| property | xsd:string | required | attribute: property data id as defined in PropertyDetails section of MPRD_Dictionary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| technique | xsd:string | | attribute: technique id as defined in MeasurementTechniqueDetails section of MPRD_Dictionary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| datasource | xsd:string | | attribute: data source id as defined in DataSourceDetails section of MPRD_Dictionary | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| specimen | xsd:string | | attribute: specimen id as defined in SpecimenDetails in the Dictionary element. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| test | xsd:string | | attribute: test condition id as defined in TestConditionDetails in Metadata. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| delimiter | | | attribute: delimiter specifies the delimiter that separates multiple values in the Data, Qualifier, Uncertainty, and ParameterValue elements. The default value is a comma (','). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| quote | xsd:string | | attribute: quote specifies the string that is used to quote values in the Data, Qualifier, Uncertainty and ParameterValue elements. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| annotation | PropertyData contains the property data of the component. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

element **ComponentDetails/AssociationDetails**

| | |
|------------|--|
| diagram |  <p>The diagram illustrates the structure of the AssociationDetails element. On the left, a rectangular box labeled AssociationDetails has a small square connector on its right side. This connector is linked by a dashed line to a larger, dashed rectangular box. Inside this dashed box, the title AssociationDetails is written at the top. Below the title, three smaller rectangular boxes are stacked vertically, each with a small square connector on its left side. These boxes are labeled Associate, Relationship, and Notes from top to bottom. The dashed line from the AssociationDetails box on the left connects to the left-side connectors of these three internal boxes.</p> |
| type | AssociationDetails |
| annotation | AssociationDetails contains a description of relationships of the component to other components. |

element **ComponentDetails/ComponentDetails**

| diagram |  | | | | | | | | | | | |
|------------|---|----------|---|-----|------------|----|--------|----------|---|--|--|--|
| type | ComponentDetails | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>optional</td><td>attribute: id is used in AssociationDetails element. The component id can be paired with other components with relationships defined in Relationship element.</td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | optional | attribute: id is used in AssociationDetails element. The component id can be paired with other components with relationships defined in Relationship element. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| id | xsd:ID | optional | attribute: id is used in AssociationDetails element. The component id can be paired with other components with relationships defined in Relationship element. | | | | | | | | | |
| annotation | ComponentDetails contains a description of a component within the component and is used to support encoding of information for complex materials systems such as composites. | | | | | | | | | | | |

element **ComponentDetails/Notes**

| | |
|---------|---|
| diagram |  |
| type | Notes |

A.2.7 Compound

complexType **Compound**

| | |
|------------|--|
| diagram | |
| used by | element ChemicalComposition/Compound |
| annotation | Complex-type: containing the elemental description of a chemical compound. |

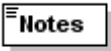
element **Compound/Element**

| | |
|------------|---|
| diagram | |
| type | Element |
| annotation | Element contains the description of a chemical element. |

element **Compound/Concentration**

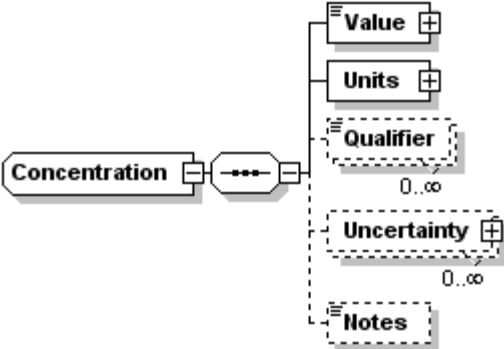
| | |
|------------|---|
| diagram | |
| type | Concentration |
| annotation | Concentration contains the concentration of the compound. |

element **Compound/Notes**

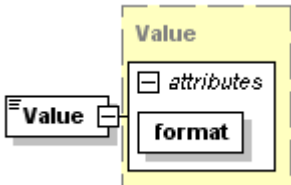
| | |
|------------|---|
| diagram |  |
| type | Notes |
| annotation | Notes contains any additional information concerning the compound. |

A.2.8 Concentration

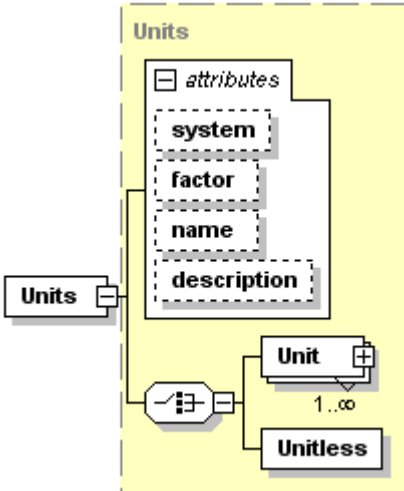
complexType **Concentration**

| | |
|------------|---|
| diagram |  |
| used by | elements Compound/Concentration Element/Concentration PhaseComposition/Concentration |
| annotation | Complex-type: containing concentration value definitions. |


element **Concentration/Value**

| diagram |  | | | | | | | | |
|------------|--|----------|------------|-----|------------|--------|------------|----------|--|
| type | Value | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>format</td><td>DataFormat</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | format | DataFormat | required | |
| Name | Type | Use | Annotation | | | | | | |
| format | DataFormat | required | | | | | | | |
| annotation | Value contains the value of the concentration and has one required attribute, format, for indicating the format of the value. | | | | | | | | |

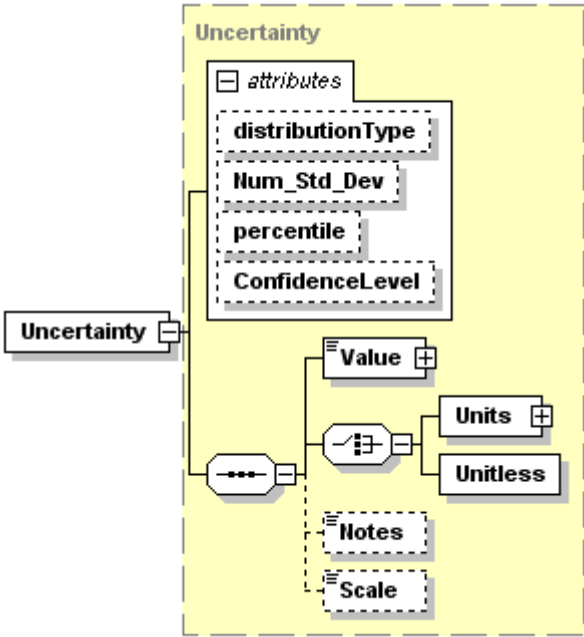
element **Concentration/Units**

| diagram |  | | | | | | | | | | | | | | | | | | | | | | |
|-------------|---|------|---|-----|------------|--------|------------|--|---|--------|-----------|--|---|------|------------|--|---|-------------|------------|--|---|--|--|
| type | Units | | | | | | | | | | | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>system</td><td>xsd:string</td><td></td><td>attribute: system is used to indicate the units system, such as "SI."</td></tr><tr><td>factor</td><td>xsd:float</td><td></td><td>attribute: factor is used to indicate a constant multiplier in floating point format.</td></tr><tr><td>name</td><td>xsd:string</td><td></td><td>attribute: name is used to indicate the name of the units. For example: "m/s"</td></tr><tr><td>description</td><td>xsd:string</td><td></td><td>attribute: description is used to describe the units. For example: "meter per second"</td></tr></table> | Name | Type | Use | Annotation | system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." | factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. | name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s" | description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second" | | |
| Name | Type | Use | Annotation | | | | | | | | | | | | | | | | | | | | |
| system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." | | | | | | | | | | | | | | | | | | | | |
| factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. | | | | | | | | | | | | | | | | | | | | |
| name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s" | | | | | | | | | | | | | | | | | | | | |
| description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second" | | | | | | | | | | | | | | | | | | | | |
| annotation | Units contains the units for the value of the concentration. | | | | | | | | | | | | | | | | | | | | | | |

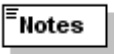
element **Concentration/Qualifier**

| | | | | |
|------------|---|--|--|--|
| diagram |  | | | |
| type | Qualifier | | | |
| annotation | Qualifier contains any qualifier pertinent to the value of the concentration (e.g. "min," "max," etc.). | | | |

element **Concentration/Uncertainty**

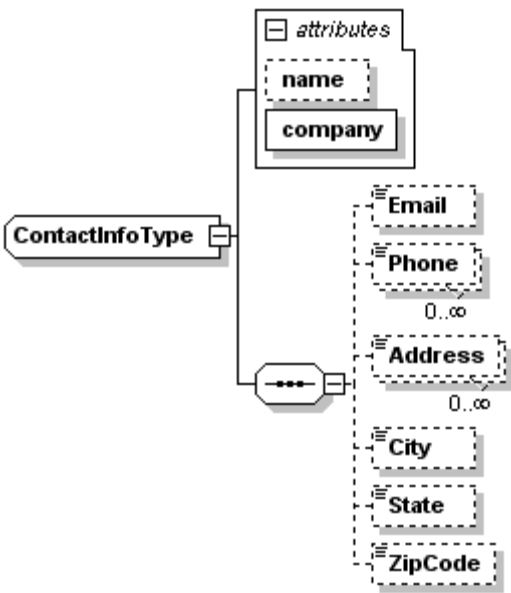
| | | | | | |
|------------|---|------------|----------|-----------------|---|
| diagram |  | | | | |
| type | Uncertainty | | | | |
| attributes | Name | Type | Use | Default | Annotation |
| | distributionType | xsd:string | optional | Normal/Gaussian | attribute: distributionType is a description of the nature of the uncertainty value, for example '6 sigma', 'Gaussian' or '2 std dev.' |
| | Num_Std_Dev | xsd:float | optional | 2 | |
| | percentile | xsd:float | optional | | attribute: percentile is a value indicating the percentage of the data population that have values less than or equal to that expressed by the Uncertainty value. |
| | ConfidenceLevel | xsd:float | optional | | |
| annotation | Uncertainty contains the measurement uncertainty(ies) of the data in Value element. | | | | |

element **Concentration/Notes**

| | |
|------------|---|
| diagram |  |
| type | Notes |
| annotation | Notes contains any additional information concerning the concentration. |

A.2.9 ContactInfoType

complexType **ContactInfoType**

| | | | | |
|------------|--|--|----------|------------|
| diagram |  | | | |
| used by | elements | DocHeader/GovernmentContact DocHeader/IndustryContact | | |
| attributes | Name | Type | Use | Annotation |
| | name | xsd:string | | |
| | company | | required | |
| annotation | Complex-type: containing the identity of, and means to communicate with, person(s) and organization(s) associated with the data set. | | | |

element **ContactInfoType/Email**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

element **ContactInfoType/Phone**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

element **ContactInfoType/Address**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

element **ContactInfoType/City**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

element **ContactInfoType/State**

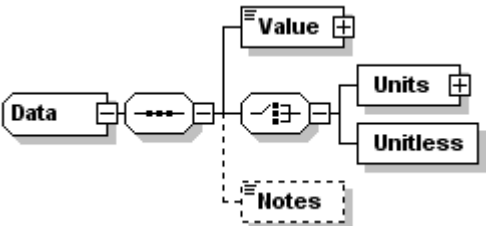
| | |
|---------|---|
| diagram |  |
| type | xsd:string |

element **ContactInfoType/ZipCode**

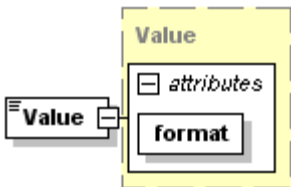
| | |
|---------|---|
| diagram |  |
| type | restriction of xsd:string |

A.2.10 Data

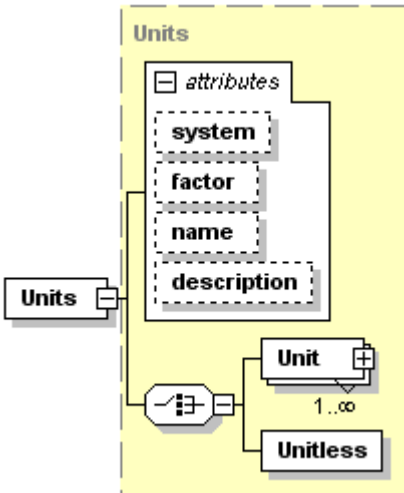
complexType **Data**

| | |
|---------|---|
| diagram |  |
| used by | elements ParameterValue/Data PropertyData/Data |

element **Data/Value**

| diagram |  | | | | | | | | |
|------------|--|----------|------------|-----|------------|--------|------------|----------|--|
| type | Value | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>format</td><td>DataFormat</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | format | DataFormat | required | |
| Name | Type | Use | Annotation | | | | | | |
| format | DataFormat | required | | | | | | | |
| annotation | Value contains the value of the data. | | | | | | | | |

element **Data/Units**

| diagram |  | | | | | | | | | | | | | | | | | | | | | | | |
|-------------|---|------|--|-----|------------|--------|------------|--|---|--------|-----------|--|---|------|------------|--|--|-------------|------------|--|--|--|--|--|
| type | Units | | | | | | | | | | | | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>system</td><td>xsd:string</td><td></td><td>attribute: system is used to indicate the units system, such as "SI."</td></tr><tr><td>factor</td><td>xsd:float</td><td></td><td>attribute: factor is used to indicate a constant multiplier in floating point format.</td></tr><tr><td>name</td><td>xsd:string</td><td></td><td>attribute: name is used to indicate the name of the units. For example: "m/s".</td></tr><tr><td>description</td><td>xsd:string</td><td></td><td>attribute: description is used to describe the units. For example: "meter per second".</td></tr></table> | Name | Type | Use | Annotation | system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." | factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. | name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s". | description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second". | | | |
| Name | Type | Use | Annotation | | | | | | | | | | | | | | | | | | | | | |
| system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." | | | | | | | | | | | | | | | | | | | | | |
| factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. | | | | | | | | | | | | | | | | | | | | | |
| name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s". | | | | | | | | | | | | | | | | | | | | | |
| description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second". | | | | | | | | | | | | | | | | | | | | | |
| annotation | Units contains the units for the value of the data. | | | | | | | | | | | | | | | | | | | | | | | |

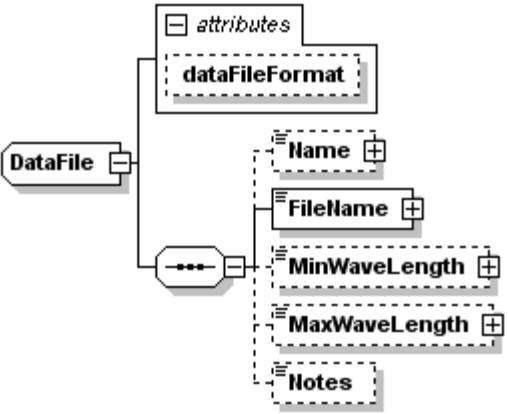
element **Data/Unitless**

| | |
|---------|---|
| diagram |  |
| type | Unitless |

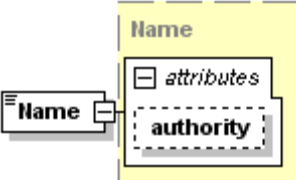
element **Data/Notes**

| | |
|---------|---|
| diagram |  |
| type | Notes |

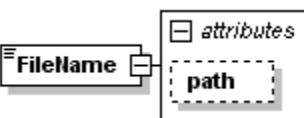
A.2.11 DataFilecomplexType **DataFile**

| | | | | |
|------------|--|------------|-----|--|
| diagram |  | | | |
| used by | element PropertyData/DataFile | | | |
| attributes | Name | Type | Use | Annotation |
| | dataFileFormat | xsd:string | | dataFileFormat is an ID referenced from Global MPRD_Dictionary where the file format is defined. |
| annotation | Complex-type: containing references to large data tables external to the XML document. | | | |

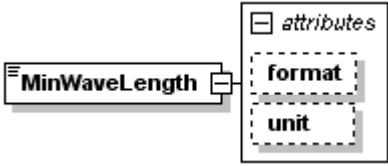
element **DataFile/Name**

| | | | | |
|------------|---|------------|----------|--|
| diagram |  | | | |
| type | Name | | | |
| attributes | Name | Type | Use | Annotation |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. |

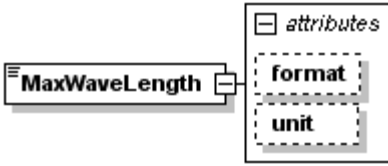
element **DataFile/FileName**

| | | | | |
|------------|---|------------|----------|------------|
| diagram |  | | | |
| type | extension of xsd:string | | | |
| attributes | Name | Type | Use | Annotation |
| | path | xsd:string | optional | |

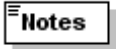
element **DataFile/MinWaveLength**

| | | | | |
|------------|---|-------------------|-----|------------|
| diagram |  | | | |
| type | extension of xsd:string | | | |
| attributes | Name | Type | Use | Annotation |
| | format | DataFormat | | |
| | unit | xsd:string | | |

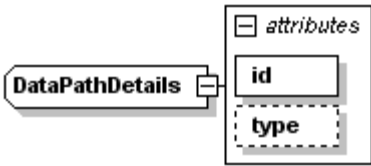
element **DataFile/MaxWaveLength**

| | | | | |
|------------|---|-------------------|-----|------------|
| diagram |  | | | |
| type | extension of xsd:string | | | |
| attributes | Name | Type | Use | Annotation |
| | format | DataFormat | | |
| | unit | xsd:string | | |

element **DataFile/Notes**

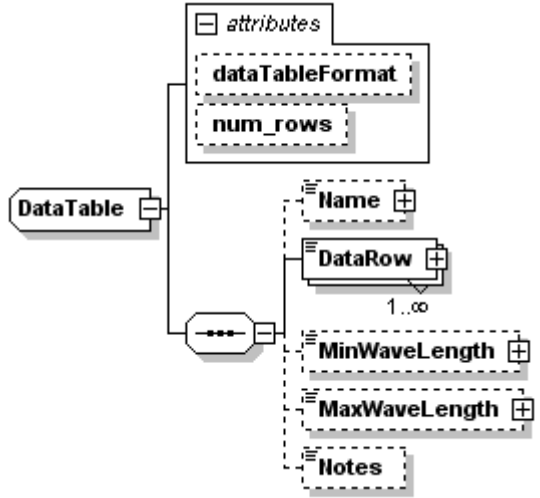
| | | | | |
|---------|---|--|--|--|
| diagram |  | | | |
| type | Notes | | | |

complexType **DataPathDetails**

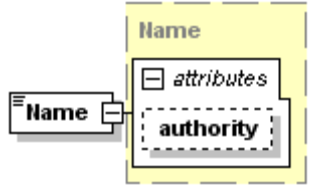
| | | | | |
|------------|---|-------------------|----------|------------|
| diagram |  | | | |
| type | extension of xsd:string | | | |
| used by | element Dictionary/DataPathDetails | | | |
| attributes | Name | Type | Use | Annotation |
| | id | xsd:ID | required | |
| | type | xsd:string | optional | |
| annotation | <p>Complex-type: containing ids and descriptions of data file paths referenced by attribute "path" of complex type "DataFile".</p> <p>DataPathDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document. delimiter and row data format.</p> <p>Attribute "type" defines the path type, e.g. "URL", "local", "remote", "relative", etc.</p> | | | |

A.2.12 DataTable

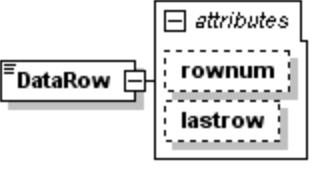
complexType **DataTable**

| | | | | | | |
|------------|---|---------------------|----------|---------|-------|------------|
| diagram |  | | | | | |
| used by | element PropertyData/DataTable | | | | | |
| attributes | Name | Type | Use | Default | Fixed | Annotation |
| | dataTableFormat | xsd:string | optional | | | |
| | num_rows | xsd:positiveInteger | optional | | | |
| annotation | Complex-type: containing datarows of tabular data within the XML document. | | | | | |

element **DataTable/Name**

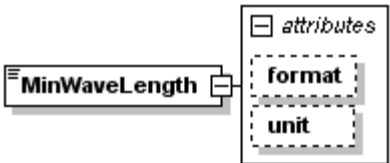
| | | | | | | |
|------------|---|------------|----------|--|--|--|
| diagram |  | | | | | |
| type | Name | | | | | |
| attributes | Name | Type | Use | Annotation | | |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | |

element **DataTable/DataRow**

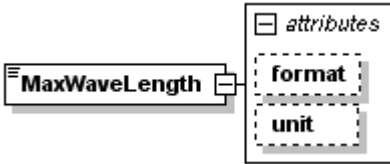
| | | | | | | |
|------------|---|-----------------|----------|------------|--|--|
| diagram |  | | | | | |
| type | extension of xsd:string | | | | | |
| attributes | Name | Type | Use | Annotation | | |
| | rownum | xsd:unsignedInt | optional | | | |

| | | | | |
|--|---------|-------------|----------|--|
| | lastrow | xsd:boolean | optional | |
|--|---------|-------------|----------|--|

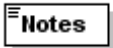
element **DataTable/MinWaveLength**

| | | | | |
|------------|---|-------------------|-----|------------|
| diagram |  | | | |
| type | extension of xsd:string | | | |
| attributes | Name | Type | Use | Annotation |
| | format | DataFormat | | |
| | unit | xsd:string | | |

element **DataTable/MaxWaveLength**

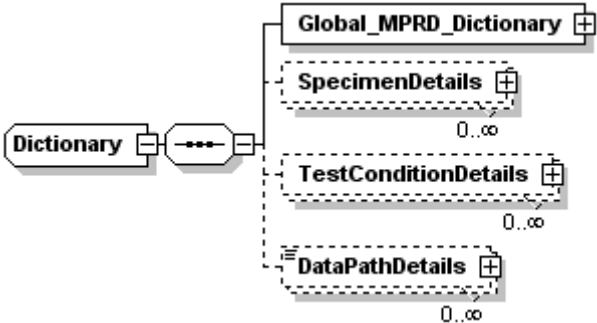
| | | | | |
|------------|---|-------------------|-----|------------|
| diagram |  | | | |
| type | extension of xsd:string | | | |
| attributes | Name | Type | Use | Annotation |
| | format | DataFormat | | |
| | unit | xsd:string | | |

element **DataTable/Notes**

| | | | | |
|---------|---|--|--|--|
| diagram |  | | | |
| type | Notes | | | |

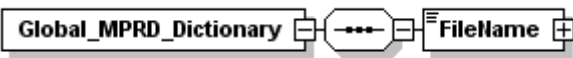
A.2.13 Dictionary

complexType **Dictionary**

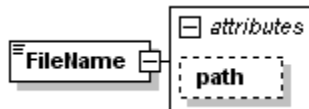
| | | | | |
|------------|---|--|--|--|
| diagram |  | | | |
| used by | element MPRD_Doc/Dictionary | | | |
| annotation | Complex-type: containing local data dictionary and location of external global data dictionary. The | | | |

| | |
|--|---|
| | dictionaries contain details describing ids used in MPRD_Doc. |
|--|---|

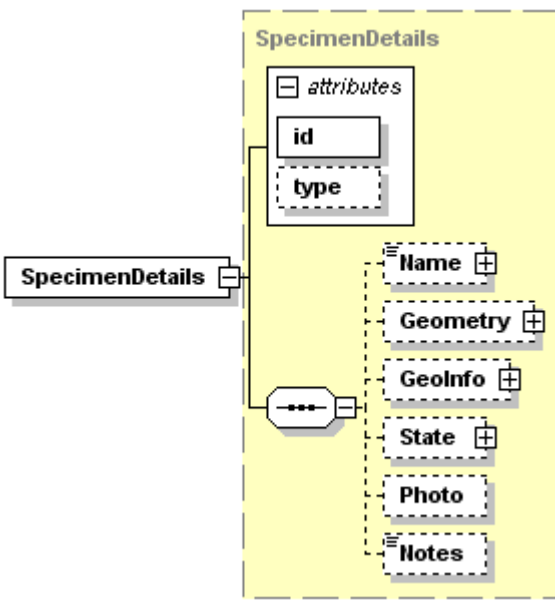
element Dictionary/Global_MPRD_Dictionary

| | |
|------------|---|
| diagram |  The diagram shows a box labeled 'Global_MPRD_Dictionary' connected to a box labeled 'FileName' via a connector with three dots, indicating a relationship or reference. |
| annotation | Global MPRD_Dictionary file location. This file contains global "id" defintions being referenced by this MPRD_Doc. |

element Dictionary/Global_MPRD_Dictionary/FileName

| diagram |  | | | | | | | | | | | |
|------------|---|----------|------------|-----|------------|------|-------------------|----------|--|--|--|--|
| type | extension of xsd:string | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>path</td><td>xsd:string</td><td>optional</td><td></td></tr></table> | Name | Type | Use | Annotation | path | xsd:string | optional | | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| path | xsd:string | optional | | | | | | | | | | |

element Dictionary/SpecimenDetails

| diagram |  <p>The diagram illustrates the structure of the SpecimenDetails element. A box labeled 'SpecimenDetails' is connected to a larger box labeled 'SpecimenDetails' (highlighted in yellow). This larger box contains an 'attributes' section with 'id' (required) and 'type' (optional) attributes. Below the attributes, a connector with three dots leads to a list of child elements: Name, Geometry, GeoInfo, State, Photo, and Notes. Each element has a small box with a plus sign next to it, indicating it is optional.</p> | | | | | | | | | | | | |
|------------|---|----------|------------|-----|------------|----|---------------|----------|--|------|-------------------|----------|--|
| type | SpecimenDetails | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr><tr><td>type</td><td>xsd:string</td><td>optional</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | | type | xsd:string | optional | |
| Name | Type | Use | Annotation | | | | | | | | | | |
| id | xsd:ID | required | | | | | | | | | | | |
| type | xsd:string | optional | | | | | | | | | | | |
| annotation | <p>SpecimenDetails contains ids and descriptions of the specimen materials. The specifics include locations, season, geometry, physical states, photos and any notes.</p> <p>SpecimenDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionay xml document. delimiter and row data format.</p> <p>Optional attribute "type" specifies the type of the specimen, e.g. "cylindrical," "rectangular," "full cross-section," "pressed," etc.</p> <p>Example:</p> | | | | | | | | | | | | |


```
<SpecimenDetails id="sp-granite1">
  <Name authority="Auth3">Granite (fragments and grus)</Name>
  <Geometry>
    <Shape>fragments and grus</Shape>
  </Geometry>
  <GeoInfo>
    <GeoLocation>
      <Region>North America</Region>
      <Country>USA</Country>
      <Territory>California</Territory>
      <Notes>Riverside Co., Joshua Tree National Park, east of Quail Springs </Notes>
    </GeoLocation>
  </GeoInfo>
</SpecimenDetails>
```

element Dictionary/TestConditionDetails

| diagram | | | | | | | | | | | | |
|------------|--|----------|------------|-----|------------|----|--------|----------|--|--|--|--|
| type | TestConditionDetails | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| id | xsd:ID | required | | | | | | | | | | |
| annotation | TestConditionDetails contains ids and descriptions of the test conditions referenced by attribute "test" of complex type "PropertyData". | | | | | | | | | | | |

element Dictionary/DataPathDetails

| diagram | | | | | | | | | | | | | |
|------------|---|----------|------------|-----|------------|----|---------------|----------|--|------|-------------------|----------|--|
| type | DataPathDetails | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr><tr><td>type</td><td>xsd:string</td><td>optional</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | | type | xsd:string | optional | |
| Name | Type | Use | Annotation | | | | | | | | | | |
| id | xsd:ID | required | | | | | | | | | | | |
| type | xsd:string | optional | | | | | | | | | | | |
| annotation | <p>DataPathDetails contains ids and descriptions of data file paths referenced by attribute "path" of complex type "DataFile".</p> <p>DataPathDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document. delimiter and row data format.</p> <p>Attribute "type" defines the path type, e.g. "URL", "local", "remote", "relative", etc.</p> <p>Example: <DataPathDetails id="local-tecarmy" type="local">..\MPRD_DATA\tecarmy</DataPathDetails></p> | | | | | | | | | | | | |

A.2.14 DimensionalDetails

complexType DimensionalDetails

| | |
|------------|--|
| diagram | |
| used by | element Characterization/DimensionalDetails |
| annotation | Complex-type: containing a description of a dimensional characteristic (e.g. grain size, porosity, precipitate size and distribution, etc.) of the bulk material or component and is composed of the following elements. |

element DimensionalDetails/Name

| diagram | | | | | | | | | | | | |
|------------|---|----------|--|-----|------------|-----------|------------|----------|--|--|--|--|
| type | Name | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | | | | | | | |
| annotation | Name contains the name of the dimensional characteristic under the authoritative source. | | | | | | | | | | | |

element DimensionalDetails/Value

| diagram | | | | | | | | | |
|------------|---|----------|------------|-----|------------|--------|-------------------|----------|--|
| type | Value | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>format</td><td>DataFormat</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | format | DataFormat | required | |
| Name | Type | Use | Annotation | | | | | | |
| format | DataFormat | required | | | | | | | |
| annotation | Value contains the value of the dimensional characteristic. | | | | | | | | |

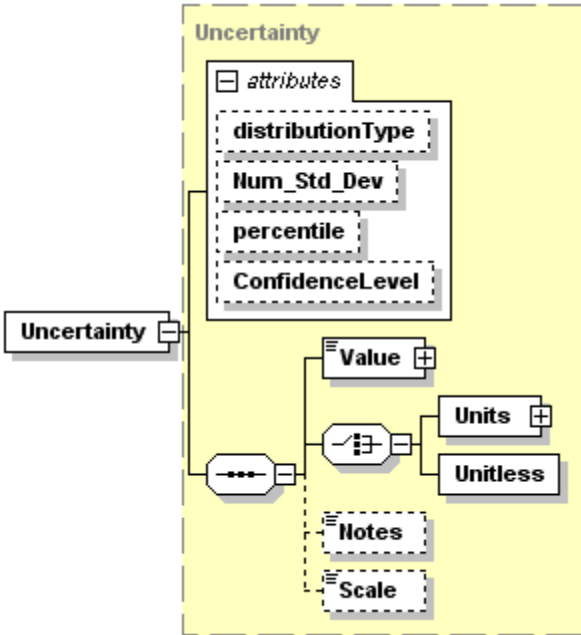
element **DimensionalDetails/Units**

| diagram | <p>The diagram shows a UML class-like structure for 'Units'. A central box labeled 'Units' contains an 'attributes' container with four attributes: 'system', 'factor', 'name', and 'description'. A line connects the 'Units' box to a multiplicity '1..∞' which is connected to a box labeled 'Unitless'.</p> | | | | | | | | | | | | | | | | | | | | |
|-------------|---|------|--|-----|------------|--------|-------------------|--|---|--------|------------------|--|---|------|-------------------|--|--|-------------|-------------------|--|--|
| type | Units | | | | | | | | | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>system</td><td>xsd:string</td><td></td><td>attribute: system is used to indicate the units system, such as "SI."</td></tr><tr><td>factor</td><td>xsd:float</td><td></td><td>attribute: factor is used to indicate a constant multiplier in floating point format.</td></tr><tr><td>name</td><td>xsd:string</td><td></td><td>attribute: name is used to indicate the name of the units. For example: "m/s".</td></tr><tr><td>description</td><td>xsd:string</td><td></td><td>attribute: description is used to describe the units. For example: "meter per second".</td></tr></table> | Name | Type | Use | Annotation | system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." | factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. | name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s". | description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second". |
| Name | Type | Use | Annotation | | | | | | | | | | | | | | | | | | |
| system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." | | | | | | | | | | | | | | | | | | |
| factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. | | | | | | | | | | | | | | | | | | |
| name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s". | | | | | | | | | | | | | | | | | | |
| description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second". | | | | | | | | | | | | | | | | | | |
| annotation | Units contains the units for the value of the dimensional characteristic. | | | | | | | | | | | | | | | | | | | | |


element **DimensionalDetails/Qualifier**

| | | | | |
|------------|--|--|--|--|
| diagram | | | | |
| type | xsd:string | | | |
| annotation | Qualifier contains any qualifier pertinent to the value of the dimensional characteristic (e.g. "min," "max," etc.). | | | |

element **DimensionalDetails/Uncertainty**

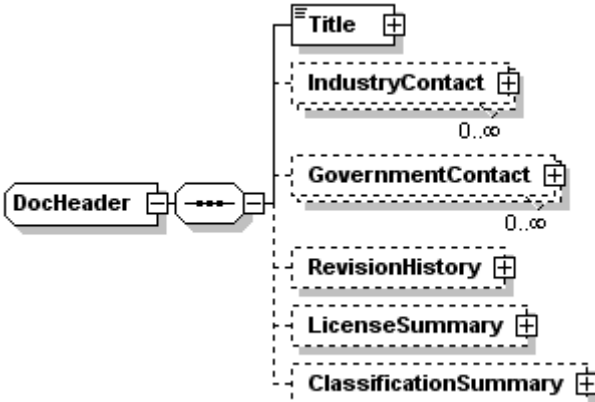
| diagram |  | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------------|---|----------|-----------------|---|---------|------------|------------------|-------------------|----------|-----------------|--|-------------|------------------|----------|---|--|------------|------------------|----------|--|---|-----------------|------------------|----------|--|--|
| type | Uncertainty | | | | | | | | | | | | | | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Default</th><th>Annotation</th></tr><tr><td>distributionType</td><td>xsd:string</td><td>optional</td><td>Normal/Gaussian</td><td>attribute: distributionType is a description of the nature of the uncertainty value, for example '6 sigma', 'Gaussian' or '2 std dev.'</td></tr><tr><td>Num_Std_Dev</td><td>xsd:float</td><td>optional</td><td>2</td><td></td></tr><tr><td>percentile</td><td>xsd:float</td><td>optional</td><td></td><td>attribute: percentile is a value indicating the percentage of the data population that have values less than or equal to that expressed by the Uncertainty value.</td></tr><tr><td>ConfidenceLevel</td><td>xsd:float</td><td>optional</td><td></td><td></td></tr></table> | Name | Type | Use | Default | Annotation | distributionType | xsd:string | optional | Normal/Gaussian | attribute: distributionType is a description of the nature of the uncertainty value, for example '6 sigma', 'Gaussian' or '2 std dev.' | Num_Std_Dev | xsd:float | optional | 2 | | percentile | xsd:float | optional | | attribute: percentile is a value indicating the percentage of the data population that have values less than or equal to that expressed by the Uncertainty value. | ConfidenceLevel | xsd:float | optional | | |
| Name | Type | Use | Default | Annotation | | | | | | | | | | | | | | | | | | | | | | |
| distributionType | xsd:string | optional | Normal/Gaussian | attribute: distributionType is a description of the nature of the uncertainty value, for example '6 sigma', 'Gaussian' or '2 std dev.' | | | | | | | | | | | | | | | | | | | | | | |
| Num_Std_Dev | xsd:float | optional | 2 | | | | | | | | | | | | | | | | | | | | | | | |
| percentile | xsd:float | optional | | attribute: percentile is a value indicating the percentage of the data population that have values less than or equal to that expressed by the Uncertainty value. | | | | | | | | | | | | | | | | | | | | | | |
| ConfidenceLevel | xsd:float | optional | | | | | | | | | | | | | | | | | | | | | | | | |
| annotation | Uncertainty contains the measurement uncertainty(ies) of the data. | | | | | | | | | | | | | | | | | | | | | | | | | |

element **DimensionalDetails/Notes**


| | | | | | |
|------------|--|--|--|--|--|
| diagram |  | | | | |
| type | Notes | | | | |
| annotation | Notes contains any additional information concerning the dimensional characteristic. | | | | |

A.2.15 DocHeader

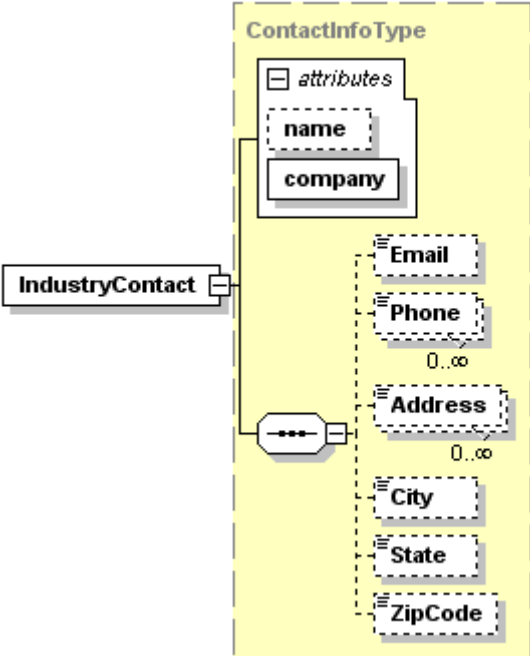
complexType DocHeader

| | |
|------------|---|
| diagram |  |
| used by | element MPRD_Doc/DocHeader |
| annotation | Complex-type: containing MPRD_Doc administrative information. |

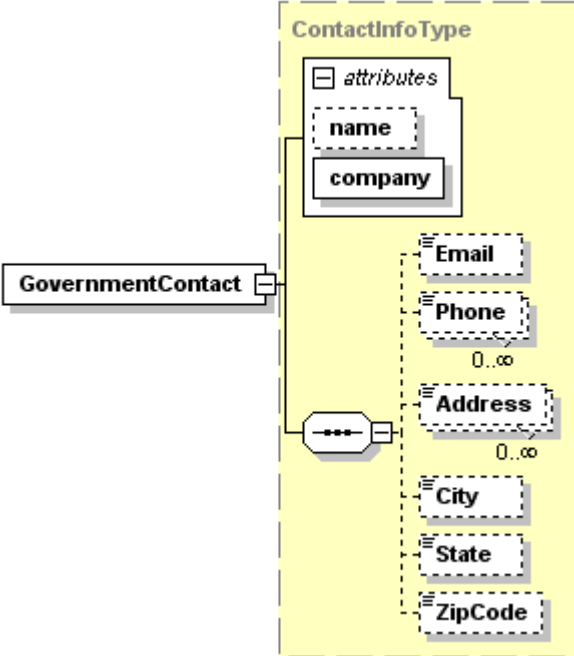
element DocHeader/Title

| | | | | | | |
|------------|--|------------|----------|---------|-------|------------|
| diagram |  | | | | | |
| type | extension of xsd:string | | | | | |
| attributes | Name | Type | Use | Default | Fixed | Annotation |
| | description | xsd:string | optional | | | |

element **DocHeader/IndustryContact**

| | | | | | |
|------------|---|------------|----------|------------|--|
| diagram |  | | | | |
| type | ContactInfoType | | | | |
| attributes | Name | Type | Use | Annotation | |
| | name | xsd:string | | | |
| | company | | required | | |

element **DocHeader/GovernmentContact**

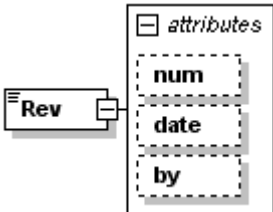
| | | | | | |
|---------|---|--|--|--|--|
| diagram |  | | | | |
|---------|---|--|--|--|--|

| | | | | |
|------------|-----------------|------------|----------|------------|
| type | ContactInfoType | | | |
| attributes | Name | Type | Use | Annotation |
| | name | xsd:string | | |
| | company | | required | |

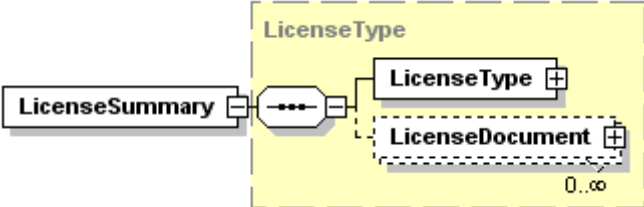
element DocHeader/RevisionHistory

| | |
|---------|--|
| diagram |  <p>The diagram shows a box labeled 'RevisionHistory' connected to a sequence of three 'Rev' boxes. The first 'Rev' box is connected to a dashed line, which is then connected to the second 'Rev' box, which is connected to a third 'Rev' box. The third 'Rev' box has a '+' sign in its top right corner. Below the third 'Rev' box is the cardinality '1..∞'.</p> |
|---------|--|

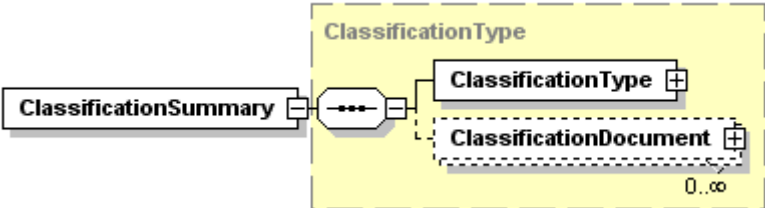
element DocHeader/RevisionHistory/Rev

| | | | | | | | | | | | | | | | | | |
|------------|--|------|------------|-----|------------|-----|-------------------|--|--|------|-----------------|--|--|----|-------------------|--|--|
| diagram |  <p>The diagram shows a box labeled 'Rev' connected to a dashed box labeled 'attributes'. Inside the 'attributes' box are three dashed boxes labeled 'num', 'date', and 'by'.</p> | | | | | | | | | | | | | | | | |
| type | extension of xsd:string | | | | | | | | | | | | | | | | |
| attributes | <table><tr><td>Name</td><td>Type</td><td>Use</td><td>Annotation</td></tr><tr><td>num</td><td>xsd:string</td><td></td><td></td></tr><tr><td>date</td><td>xsd:date</td><td></td><td></td></tr><tr><td>by</td><td>xsd:string</td><td></td><td></td></tr></table> | Name | Type | Use | Annotation | num | xsd:string | | | date | xsd:date | | | by | xsd:string | | |
| Name | Type | Use | Annotation | | | | | | | | | | | | | | |
| num | xsd:string | | | | | | | | | | | | | | | | |
| date | xsd:date | | | | | | | | | | | | | | | | |
| by | xsd:string | | | | | | | | | | | | | | | | |

element DocHeader/LicenseSummary

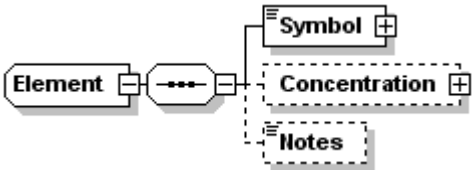
| | |
|------------|---|
| diagram |  <p>The diagram shows a box labeled 'LicenseSummary' connected to a sequence of two boxes: 'LicenseType' and 'LicenseDocument'. The 'LicenseType' box is connected to a dashed line, which is then connected to the 'LicenseDocument' box. Both boxes have a '+' sign in their top right corner. The 'LicenseDocument' box is enclosed in a dashed box with the cardinality '0..∞' below it.</p> |
| type | LicenseType |
| annotation | Restrictions and legal prerequisites for accessing and using the overall dataset. |

element DocHeader/ClassificationSummary

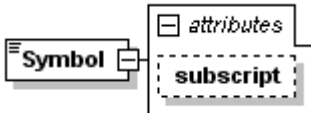
| | |
|---------|--|
| diagram |  <p>The diagram shows a box labeled 'ClassificationSummary' connected to a sequence of two boxes: 'ClassificationType' and 'ClassificationDocument'. The 'ClassificationType' box is connected to a dashed line, which is then connected to the 'ClassificationDocument' box. Both boxes have a '+' sign in their top right corner. The 'ClassificationDocument' box is enclosed in a dashed box with the cardinality '0..∞' below it.</p> |
| type | ClassificationType |

| | |
|------------|---|
| annotation | Handling restrictions imposed on the overall dataset for national security, privacy, or other concerns. |
|------------|---|

A.2.16 ElementcomplexType **Element**

| | | |
|------------|---|---|
| diagram |  | |
| used by | elements | ChemicalComposition/Element Compound/Element |
| annotation | documentation | Complex-type: containing chemical element symbols and concentrations. |

element **Element/Symbol**

| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------------|---|-------------|---|-------------|----|-------------|----|-------------|----|-------------|---|-------------|---|-------------|---|-------------|---|-------------|---|-------------|----|-------------|----|-------------|----|-------------|----|-------------|----|-------------|---|-------------|---|-------------|----|-------------|----|-------------|---|-------------|----|-------------|----|-------------|----|-------------|---|-------------|----|-------------|----|-------------|----|-------------|----|-------------|----|-------------|----|-------------|----|-------------|----|-------------|----|-------------|----|-------------|----|-------------|----|-------------|----|--|
| diagram |  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| type | extension of ChemicalElementSymbol | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| facets | <table><tr><td>enumeration</td><td>H</td></tr><tr><td>enumeration</td><td>He</td></tr><tr><td>enumeration</td><td>Li</td></tr><tr><td>enumeration</td><td>Be</td></tr><tr><td>enumeration</td><td>B</td></tr><tr><td>enumeration</td><td>C</td></tr><tr><td>enumeration</td><td>N</td></tr><tr><td>enumeration</td><td>O</td></tr><tr><td>enumeration</td><td>F</td></tr><tr><td>enumeration</td><td>Ne</td></tr><tr><td>enumeration</td><td>Na</td></tr><tr><td>enumeration</td><td>Mg</td></tr><tr><td>enumeration</td><td>Al</td></tr><tr><td>enumeration</td><td>Si</td></tr><tr><td>enumeration</td><td>P</td></tr><tr><td>enumeration</td><td>S</td></tr><tr><td>enumeration</td><td>Cl</td></tr><tr><td>enumeration</td><td>Ar</td></tr><tr><td>enumeration</td><td>K</td></tr><tr><td>enumeration</td><td>Ca</td></tr><tr><td>enumeration</td><td>Sc</td></tr><tr><td>enumeration</td><td>Ti</td></tr><tr><td>enumeration</td><td>V</td></tr><tr><td>enumeration</td><td>Cr</td></tr><tr><td>enumeration</td><td>Mn</td></tr><tr><td>enumeration</td><td>Fe</td></tr><tr><td>enumeration</td><td>Co</td></tr><tr><td>enumeration</td><td>Ni</td></tr><tr><td>enumeration</td><td>Cu</td></tr><tr><td>enumeration</td><td>Zn</td></tr><tr><td>enumeration</td><td>Ga</td></tr><tr><td>enumeration</td><td>Ge</td></tr><tr><td>enumeration</td><td>As</td></tr><tr><td>enumeration</td><td>Se</td></tr><tr><td>enumeration</td><td>Br</td></tr><tr><td>enumeration</td><td>Kr</td></tr></table> | enumeration | H | enumeration | He | enumeration | Li | enumeration | Be | enumeration | B | enumeration | C | enumeration | N | enumeration | O | enumeration | F | enumeration | Ne | enumeration | Na | enumeration | Mg | enumeration | Al | enumeration | Si | enumeration | P | enumeration | S | enumeration | Cl | enumeration | Ar | enumeration | K | enumeration | Ca | enumeration | Sc | enumeration | Ti | enumeration | V | enumeration | Cr | enumeration | Mn | enumeration | Fe | enumeration | Co | enumeration | Ni | enumeration | Cu | enumeration | Zn | enumeration | Ga | enumeration | Ge | enumeration | As | enumeration | Se | enumeration | Br | enumeration | Kr | |
| enumeration | H | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | He | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Li | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Be | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | B | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | N | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | O | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | F | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Ne | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Na | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Mg | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Al | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Si | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | S | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Cl | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Ar | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | K | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Ca | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Sc | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Ti | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Cr | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Mn | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Fe | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Co | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Ni | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Cu | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Zn | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Ga | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Ge | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | As | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Se | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Br | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| enumeration | Kr | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | |
|-------------|----|
| enumeration | Rb |
| enumeration | Sr |
| enumeration | Y |
| enumeration | Zr |
| enumeration | Nb |
| enumeration | Mo |
| enumeration | Tc |
| enumeration | Ru |
| enumeration | Rh |
| enumeration | Pd |
| enumeration | Ag |
| enumeration | Cd |
| enumeration | In |
| enumeration | Sn |
| enumeration | Sb |
| enumeration | Te |
| enumeration | I |
| enumeration | Xe |
| enumeration | Cs |
| enumeration | Ba |
| enumeration | La |
| enumeration | Ce |
| enumeration | Pr |
| enumeration | Nd |
| enumeration | Pm |
| enumeration | Sm |
| enumeration | Eu |
| enumeration | Gd |
| enumeration | Tb |
| enumeration | Dy |
| enumeration | Ho |
| enumeration | Er |
| enumeration | Tm |
| enumeration | Yb |
| enumeration | Lu |
| enumeration | Hf |
| enumeration | Ta |
| enumeration | W |
| enumeration | Re |
| enumeration | Os |
| enumeration | Ir |
| enumeration | Pt |
| enumeration | Au |
| enumeration | Hg |
| enumeration | Tl |
| enumeration | Pb |
| enumeration | Bi |
| enumeration | Po |
| enumeration | At |
| enumeration | Rn |
| enumeration | Fr |
| enumeration | Ra |
| enumeration | Ac |
| enumeration | Th |
| enumeration | Pa |
| enumeration | U |
| enumeration | Np |
| enumeration | Pu |
| enumeration | Am |
| enumeration | Cm |
| enumeration | Bk |
| enumeration | Cf |
| enumeration | Es |
| enumeration | Fm |

| | | | | | | | |
|------------|---|------------|----------|---------|-------|------------|--|
| | enumeration | Md | | | | | |
| | enumeration | No | | | | | |
| | enumeration | Lr | | | | | |
| | enumeration | Rf | | | | | |
| | enumeration | Db | | | | | |
| | enumeration | Sg | | | | | |
| | enumeration | Bh | | | | | |
| | enumeration | Hs | | | | | |
| | enumeration | Mt | | | | | |
| | enumeration | Uun | | | | | |
| | enumeration | Uuu | | | | | |
| | enumeration | Uub | | | | | |
| | enumeration | Uuq | | | | | |
| | enumeration | Uuh | | | | | |
| | enumeration | Uuo | | | | | |
| attributes | Name | Type | Use | Default | Fixed | Annotation | |
| | subscript | xsd:string | optional | 1 | | | |
| annotation | This element declares the content model for Symbol, which contains the symbol for the chemical element. The entry for Symbol is selected from among the strings enumerated by the chemicalElementSymbol datatype. Symbol has one optional attribute, subscript, for indicating the subscript (formula units) of the chemical element. | | | | | | |

element **Element/Concentration**

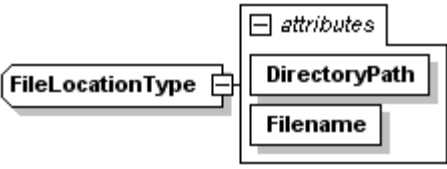
| | |
|------------|---|
| diagram | |
| type | Concentration |
| annotation | Concentration contains the concentration of the chemical element. |

element **Element/Notes**

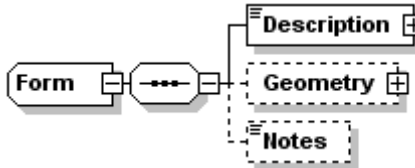
| | |
|------------|---|
| diagram | |
| type | Notes |
| annotation | Notes contains any additional information concerning the element. |

A.2.17 FileLocationType


complexType FileLocationType

| | | | | |
|------------|---|--|----------|---|
| diagram |  | | | |
| used by | elements | ClassificationType/ClassificationDocument LicenseType/LicenseDocument | | |
| attributes | Name | Type | Use | Annotation |
| | DirectoryPath | xsd:string | required | Path to the file location. This could be URL, relative, or absolute path. |
| | Filename | xsd:string | required | Filename with extension. |
| annotation | Complex-type: containing definitions of file name and directory path information. | | | |

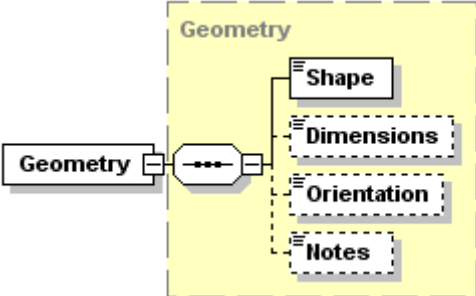
A.2.18 Form**complexType Form**

| | |
|------------|--|
| diagram |  |
| used by | elements BulkDetails/Form ComponentDetails/Form |
| annotation | Complex-type: containing the form of the bulk material. It includes a description string and a complex element Geometry to describe shape, dimensions and orientation. |

element Form/Description

| | | | | |
|------------|---|-------------------|----------|--|
| diagram |  | | | |
| type | Name | | | |
| attributes | Name | Type | Use | Annotation |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. |

element **Form/Geometry**

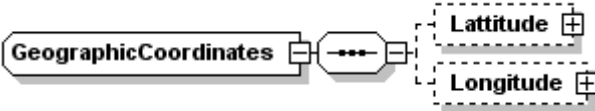
| | |
|---------|---|
| diagram |  |
| type | Geometry |

element **Form/Notes**

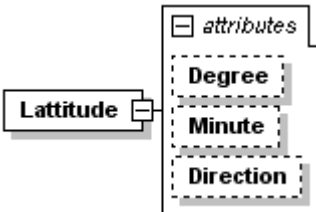
| | |
|---------|---|
| diagram |  |
| type | Notes |

A.2.19 GeographicCoordinates

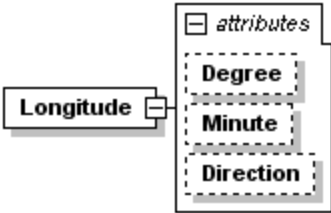
complexType **GeographicCoordinates**

| | |
|------------|---|
| diagram |  |
| used by | element GeographicLocations/Coordinate |
| annotation | Complex-type: containing lat-long location definitions. |

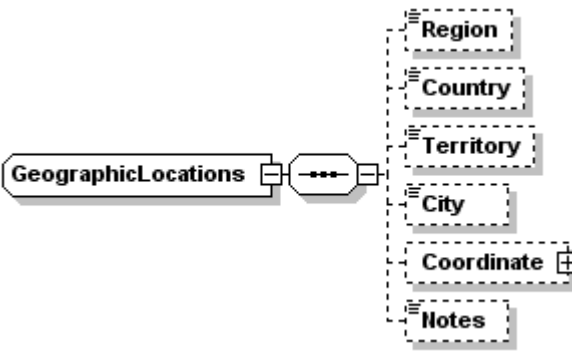
element **GeographicCoordinates/Latitude**

| diagram |  | | | | | | | | | | | | | | | | | | | |
|------------|---|------|------------|-----|------------|--------|-------------------|--|--|--------|-------------------|--|--|-----------|--|--|--|--|--|--|
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>Degree</td><td>xsd:string</td><td></td><td></td></tr><tr><td>Minute</td><td>xsd:string</td><td></td><td></td></tr><tr><td>Direction</td><td></td><td></td><td></td></tr></table> | Name | Type | Use | Annotation | Degree | xsd:string | | | Minute | xsd:string | | | Direction | | | | | | |
| Name | Type | Use | Annotation | | | | | | | | | | | | | | | | | |
| Degree | xsd:string | | | | | | | | | | | | | | | | | | | |
| Minute | xsd:string | | | | | | | | | | | | | | | | | | | |
| Direction | | | | | | | | | | | | | | | | | | | | |

element **GeographicCoordinates/Longitude**

| | | | | |
|------------|---|------------|-----|------------|
| diagram |  | | | |
| attributes | Name | Type | Use | Annotation |
| | Degree | xsd:string | | |
| | Minute | xsd:string | | |
| | Direction | | | |

A.2.20 GeographicLocationscomplexType **GeographicLocations**

| | |
|------------|--|
| diagram |  |
| used by | element SpecimenDetails/GeoInfo/GeoLocation |
| annotation | Complex-type: containing geographic location descriptions. |


element **GeographicLocations/Region**

| | | | | |
|---------|---|----------------------------|--|--|
| diagram |  | | | |
| type | GeoRegions | | | |
| facets | enumeration | Oceans | | |
| | enumeration | North America | | |
| | enumeration | Central America | | |
| | enumeration | South America | | |
| | enumeration | Europe | | |
| | enumeration | Africa | | |
| | enumeration | Australia and New Zealand | | |
| | enumeration | Antarctica | | |
| | enumeration | Asia | | |
| | enumeration | Asia Minor and Middle East | | |
| | enumeration | Southeast Asia | | |
| | enumeration | Other | | |

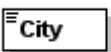
element **GeographicLocations/Country**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

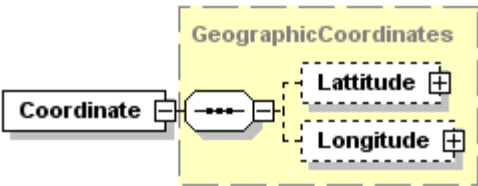
element **GeographicLocations/Territory**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

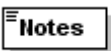
element **GeographicLocations/City**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

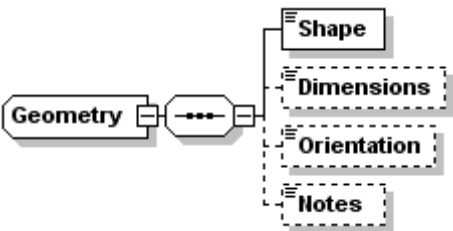
element **GeographicLocations/Coordinate**

| | |
|---------|---|
| diagram |  |
| type | GeographicCoordinates |

element **GeographicLocations/Notes**

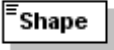
| | |
|---------|---|
| diagram |  |
| type | Notes |

A.2.21 GeometrycomplexType **Geometry**


| | |
|---------|---|
| diagram |  |
|---------|---|

| | |
|------------|---|
| used by | elements Form/Geometry SpecimenDetails/Geometry |
| annotation | <p>Complex-type: containing a description of the geometry of the bulk material, component or specimen and is composed of the following elements.</p> <ul style="list-style-type: none"> - Shape is a string describing the shape of the bulk material or component and must occur once and only once within the Geometry element. - Dimensions is a string describing the dimensions of the bulk material or component and may occur once or not at all within the Geometry element. - Orientation is a string describing the orientation of the bulk material or component and may occur once or not at all within the Geometry element. - Notes contains any additional information concerning the geometry and may occur once or not at all within the Geometry element. |


element **Geometry/Shape**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

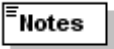
element **Geometry/Dimensions**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

element **Geometry/Orientation**

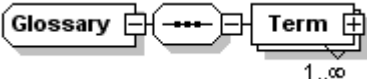
| | |
|---------|---|
| diagram |  |
| type | xsd:string |

element **Geometry/Notes**

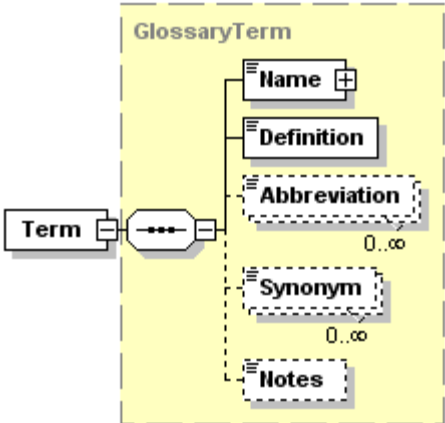
| | |
|---------|---|
| diagram |  |
| type | Notes |

A.2.22 Glossary

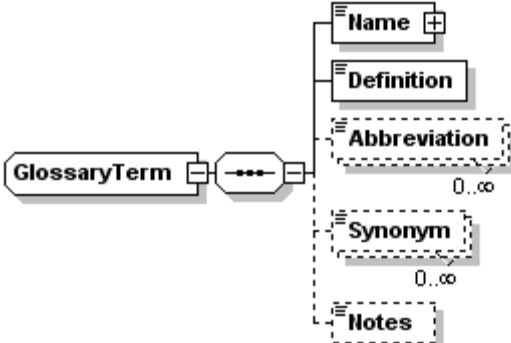
complexType **Glossary**

| | |
|------------|--|
| diagram |  |
| annotation | Complex-type: containing descriptions of material and property terms used in the document. |

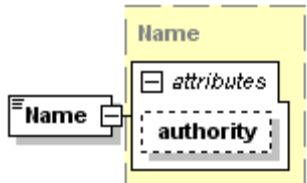
element **Glossary/Term**

| | |
|---------|---|
| diagram |  |
| type | GlossaryTerm |


complexType **GlossaryTerm**

| | |
|------------|--|
| diagram |  |
| used by | element Glossary/Term |
| annotation | Complex-type: containing definitions for GlossaryTerms. |


element **GlossaryTerm/Name**

| diagram |  | | | | | | | | |
|---------------|--|---------------|--|-----|------------|-----------|-------------------|----------|--|
| type | Name | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. |
| Name | Type | Use | Annotation | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | | | | |
| annotation | <table><tr><td>documentation</td><td>Name contains the term's name.</td></tr></table> | documentation | Name contains the term's name. | | | | | | |
| documentation | Name contains the term's name. | | | | | | | | |

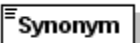
element **GlossaryTerm/Definition**

| | |
|------------|---|
| diagram |  |
| type | xsd:string |
| annotation | Definition contains the term's definition. |

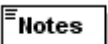
element **GlossaryTerm/Abbreviation**

| | |
|------------|---|
| diagram |  |
| type | xsd:string |
| annotation | Abbreviation contains the term's abbreviation(s). |

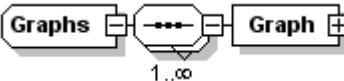
element **GlossaryTerm/Synonym**

| | |
|------------|---|
| diagram |  |
| type | xsd:string |
| annotation | Synonym contains the term's synonym(s). |


element **GlossaryTerm/Notes**

| | |
|------------|---|
| diagram |  |
| type | Notes |
| annotation | Notes contains any additional information concerning the term. |

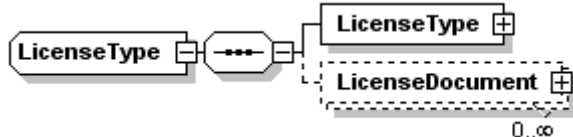
A.2.23 GraphscomplexType **Graphs**

| | |
|------------|---|
| diagram |  |
| annotation | Complex-type: containing graph definition using the W3C's Scalable Vector Graphics markup language (SVG) for describing two dimensional graphics and allows for three types of graphical objects: vector graphics shapes, images, and text. For more information concerning SVG, see the documentation at http://www.w3.org/TR/SVG/ . |

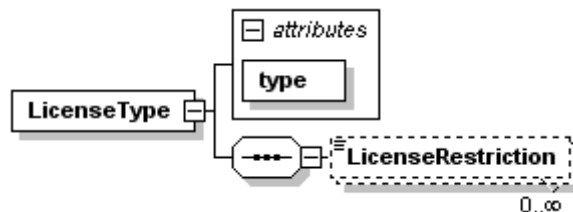
element **Graphs/Graph**

| | |
|---------|---|
| diagram |  |
|---------|---|


A.2.24 LicenseTypecomplexType **LicenseType**

| | |
|------------|--|
| diagram |  |
| used by | element DocHeader/LicenseSummary |
| annotation | Complex-type: containing restrictions and legal prerequisites for accessing and using the overall dataset or each data file. |

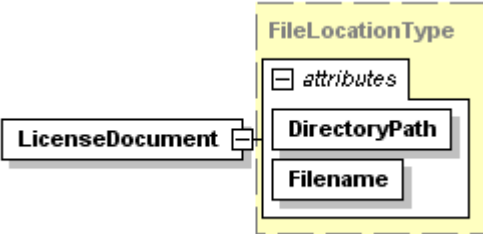
element **LicenseType/LicenseType**

| diagram |  | | | | | | | | | | | |
|------------|--|----------|----------------------------|-----|------------|------|--|----------|----------------------------|--|--|--|
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>type</td><td></td><td>required</td><td>Name of the license owner.</td></tr></table> | Name | Type | Use | Annotation | type | | required | Name of the license owner. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| type | | required | Name of the license owner. | | | | | | | | | |

element **LicenseType/LicenseType/LicenseRestriction**

| | |
|------------|---|
| diagram |  |
| type | xsd:string |
| annotation | Additional information on license restrictions. |

element **LicenseType/LicenseDocument**

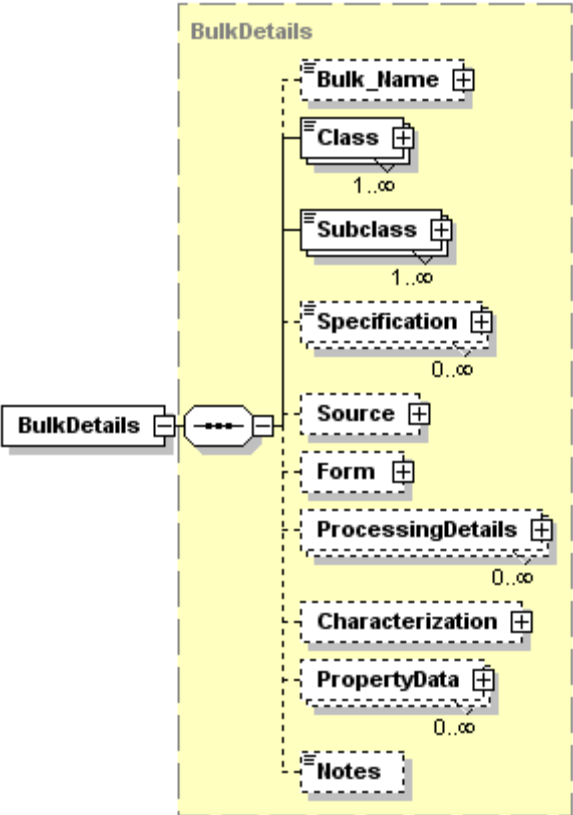
| diagram |  | | | | | | | | | | | | |
|---------------|---|----------|---|-----|------------|---------------|------------|----------|---|----------|------------|----------|--------------------------|
| type | FileLocationType | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>DirectoryPath</td><td>xsd:string</td><td>required</td><td>Path to the file location. This could be URL, relative, or absolute path.</td></tr><tr><td>Filename</td><td>xsd:string</td><td>required</td><td>Filename with extension.</td></tr></table> | Name | Type | Use | Annotation | DirectoryPath | xsd:string | required | Path to the file location. This could be URL, relative, or absolute path. | Filename | xsd:string | required | Filename with extension. |
| Name | Type | Use | Annotation | | | | | | | | | | |
| DirectoryPath | xsd:string | required | Path to the file location. This could be URL, relative, or absolute path. | | | | | | | | | | |
| Filename | xsd:string | required | Filename with extension. | | | | | | | | | | |
| annotation | License document(s) describing the license restrictions. | | | | | | | | | | | | |

A.2.25 Material

complexType **Material**

| | | | | | |
|------------|---|-------------|----------|---|--|
| diagram | | | | | |
| used by | element MPRD_Doc/Material | | | | |
| attributes | Name | Type | Use | Annotation | |
| | MPRD_ID | | required | attribute: human readable unique ID that identify the material using the following rule: [Class]_[Subclass]_[Name]] [Name] is the same as the Bulk_Name element under BulkDetails. [Class] is the same as the Class element under BulkDetails. [Subclass] is the same as the Subclass element under BulkDetails. Examples: - Vegetation_Tree_Sierra Lodgepole Pine - Liquid_Water_Distilled - Construction_Roof_Red Concrete Tile | |
| | id | xsd:ID | optional | attribute: a unique sequential index or a computer generated globally unique identification (GUID). This id will be used in managing the material database. | |
| | date | xsd:string | optional | attribute: the date the material is last updated. | |
| | layers | xsd:integer | optional | attribute: may be used to indicate the number of layers in complex systems such as composite laminates. | |
| | local_frame_of_reference | xsd:string | optional | attribute: may be used as an identification specifier for the local material orientation relative to the global frame of reference, which is especially useful for complex systems such as anisotropic materials. | |
| annotation | Complex-type: containing MPRD_Doc material definitions. | | | | |

element **Material/BulkDetails**

| | |
|---------|---|
| diagram |  <p>The diagram illustrates the structure of the BulkDetails element. A central box labeled BulkDetails is connected to a dashed container box also labeled BulkDetails. Inside this container, the following elements are listed vertically: Bulk_Name, Class (with a multiplicity of 1..∞), Subclass (with a multiplicity of 1..∞), Specification (with a multiplicity of 0..∞), Source, Form, ProcessingDetails (with a multiplicity of 0..∞), Characterization, PropertyData (with a multiplicity of 0..∞), and Notes. Each element has a small icon to its right, and the entire container is highlighted in yellow.</p> |
| type | BulkDetails |

element **Material/ComponentDetails**

| diagram | <div><div>ComponentDetails</div><div><div>attributes</div><div>id</div></div><div>ComponentDetails</div><div><div>Component_Name</div><div>Class</div><div>0..∞</div><div>Subclass</div><div>0..∞</div><div>Specification</div><div>0..∞</div><div>Source</div><div>Form</div><div>ProcessingDetails</div><div>0..∞</div><div>Characterization</div><div>PropertyData</div><div>0..∞</div><div>AssociationDetails</div><div>0..∞</div><div>ComponentDetails</div><div>0..∞</div><div>Notes</div></div></div> | | | | | | | | | | | |
|------------|--|----------|---|-----|------------|----|--------|----------|---|--|--|--|
| type | ComponentDetails | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>optional</td><td>attribute: id is used in AssociationDetails element. The component id can be paired with other components with relationships defined in Relationship element.</td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | optional | attribute: id is used in AssociationDetails element. The component id can be paired with other components with relationships defined in Relationship element. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| id | xsd:ID | optional | attribute: id is used in AssociationDetails element. The component id can be paired with other components with relationships defined in Relationship element. | | | | | | | | | |
| annotation | ComponentDetails contains description of components within the bulk material and has one optional attribute, id, which may be used as an identification specifier for the component and is especially useful for complex systems such as composite laminates. | | | | | | | | | | | |

element **Material/Graphs**

| | |
|---------|---|
| diagram |  |
|---------|---|

| | |
|------------|--|
| annotation | Graph uses the W3C's Scalable Vector Graphics markup language (SVG) for describing two dimensional graphics and allows for three types of graphical objects: vector graphics shapes, images, and text. For more information concerning SVG, see the documentation at http://www.w3.org/TR/SVG/ . |
|------------|--|

element **Material/Graphs/Graph**

| | |
|---------|--|
| diagram | |
|---------|--|

A.2.26 Name

complexType **Name**

| | | | | |
|------------|--|---|----------|--|
| diagram | | | | |
| type | extension of xsd:string | | | |
| used by | elements | BulkDetails/Bulk_Name BulkDetails/Class ComponentDetails/Class ComponentDetails/Component_Name Form/Description Term/Name SpecimenDetails/Name ProcessingDetails/Name PhaseComposition/Name GlossaryTerm/Name DimensionalDetails/Name DataTable/Name DataFile/Name ComponentDetails/Specification BulkDetails/Specification ComponentDetails/Subclass BulkDetails/Subclass | | |
| attributes | Name | Type | Use | Annotation |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. |
| annotation | Complex-type: containing material name as assigned by the authoritative source defined in the authority attribute. | | | |

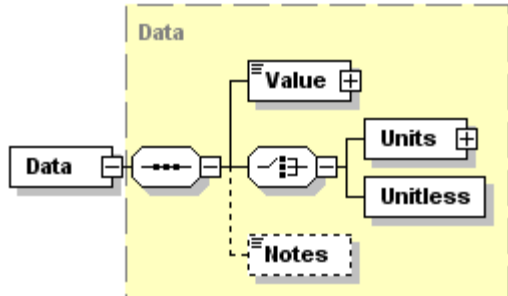
A.2.27 ParameterValue

complexType **ParameterValue**

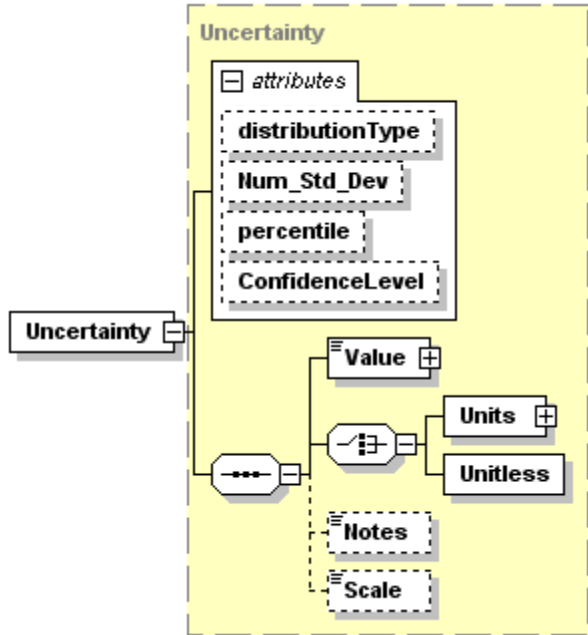
| | | | | |
|------------|-----------|--|----------|--|
| diagram | | | | |
| used by | elements | ProcessingDetails/ParameterValue PropertyData/ParameterValue TestConditionDetails/ParameterValue | | |
| attributes | Name | Type | Use | Annotation |
| | parameter | xsd:string | required | attribute: parameter references an id attribute specified in a ParameterDetails element in MPRD dictionary. |
| | format | DataFormat | required | attribute: format indicates the format of the value. If used, "mixed" indicates that the not all of the parameter values are of the same type (e.g. a "No Break" |

| | | | | |
|------------|--|--|--|---|
| | | | | value for an otherwise numeric set of test results). If used, then the "format" attribute on each "Data" item should be individually set. |
| annotation | Complex-type: containing the values of parameters. | | | |

element **ParameterValue/Data**


| | |
|------------|--|
| diagram |  <p>The diagram shows a 'Data' element box connected to a dashed-line container labeled 'Data'. Inside this container, there is a 'Value' box, a 'Notes' box, and a choice box containing 'Units' and 'Unitless'.</p> |
| type | Data |
| annotation | Data contains the parameter data. |

element **ParameterValue/Uncertainty**


| | | | | | |
|------------|---|------------|----------|-----------------|---|
| diagram |  <p>The diagram shows an 'Uncertainty' element box connected to a dashed-line container labeled 'Uncertainty'. Inside this container, there is an 'attributes' box containing 'distributionType', 'Num_Std_Dev', 'percentile', and 'ConfidenceLevel'. Below the attributes is a choice box containing 'Value', 'Units', and 'Unitless'. At the bottom of the container are 'Notes' and 'Scale'.</p> | | | | |
| type | Uncertainty | | | | |
| attributes | Name | Type | Use | Default | Annotation |
| | distributionType | xsd:string | optional | Normal/Gaussian | attribute: distributionType is a description of the nature of the uncertainty value, for example '6 sigma', 'Gaussian' or '2 std dev.'. |
| | Num_Std_Dev | xsd:float | optional | 2 | |
| | percentile | xsd:float | optional | | attribute: percentile is a value indicating the percentage of the data population that have values less than or equal to that expressed by the Uncertainty value. |
| | ConfidenceLevel | xsd:float | optional | | |

| | |
|------------|---|
| annotation | Uncertainty contains the measurement uncertainty(ies) of the data in ParameterValue and may occur once or not at all within the ParameterValue element. |
|------------|---|

element **ParameterValue/Qualifier**

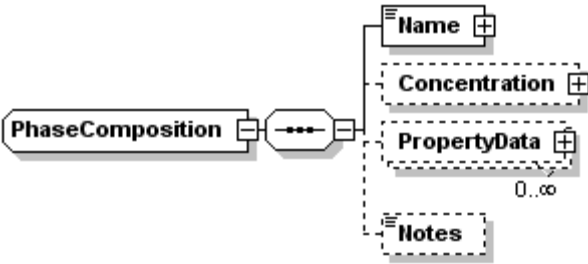
| | |
|------------|--|
| diagram |  |
| type | Qualifier |
| annotation | Qualifier contains any qualifier(s) pertinent to the data in ParameterValue(e.g. "min," "max," etc.) and may occur zero or more times within the PropertyData element. |

element **ParameterValue/Notes**

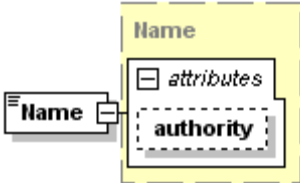
| | |
|------------|---|
| diagram |  |
| type | Notes |
| annotation | Notes contains any additional information concerning the property data. |

A.2.28 PhaseComposition

complexType **PhaseComposition**

| | |
|------------|--|
| diagram |  |
| used by | element Characterization/PhaseComposition |
| annotation | Complex-type: containing a description of a phase that comprises the bulk material or component and is composed of the following elements. |

element **PhaseComposition/Name**

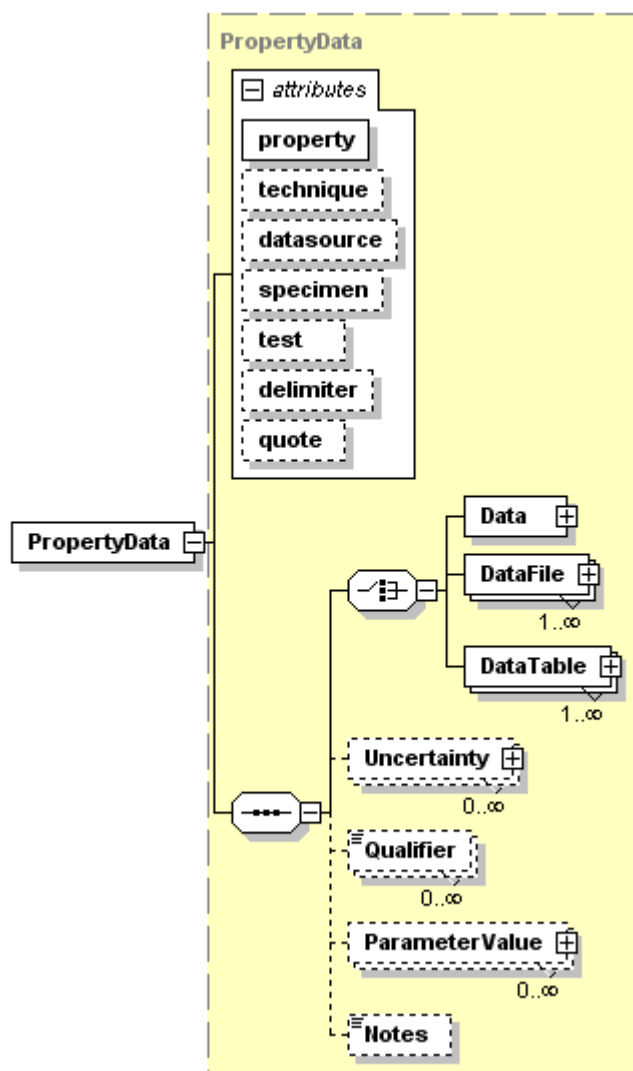
| | | | | | |
|------------|---|------------|----------|--|--|
| diagram |  | | | | |
| type | Name | | | | |
| attributes | Name | Type | Use | Annotation | |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | |
| annotation | Name contains the name of the phase. | | | | |

element **PhaseComposition/Concentration**

| | |
|------------|--|
| diagram | <p>The diagram illustrates the structure of the Concentration element. A central box labeled Concentration is connected to a dashed yellow box also labeled Concentration. Inside this dashed box, there is a vertical stack of five elements: Value, Units, Qualifier, Uncertainty, and Notes. Each of these elements has a small '+' icon in its top right corner. The Qualifier and Uncertainty elements are enclosed in dashed boxes and have a multiplicity of 0..∞ indicated below them. The Notes element is also enclosed in a dashed box.</p> |
| type | Concentration |
| annotation | Concentration contains the concentration of the phase. |

element **PhaseComposition/PropertyData**

diagram



type

PropertyData

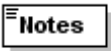
attributes

| Name | Type | Use | Annotation |
|------------|-------------------|----------|---|
| property | xsd:string | required | attribute: property data id as defined in PropertyDetails section of MPRD_Dictionary. |
| technique | xsd:string | | attribute: technique id as defined in MeasurementTechniqueDetails section of MPRD_Dictionary. |
| datasource | xsd:string | | attribute: data source id as defined in DataSourceDetails section of MPRD_Dictionary. |
| specimen | xsd:string | | attribute: specimen id as defined in SpecimenDetails in the Dictionary element. |
| test | xsd:string | | attribute: test condition id as defined in TestConditionDetails in Metadata. |
| delimiter | | | attribute: delimiter specifies the delimiter that separates multiple values in the Data, Qualifier, Uncertainty, and ParameterValue elements. The default value is a comma (','). |
| quote | xsd:string | | attribute: quote specifies the string that is used to quote values in the Data, Qualifier, Uncertainty and ParameterValue elements. |

annotation

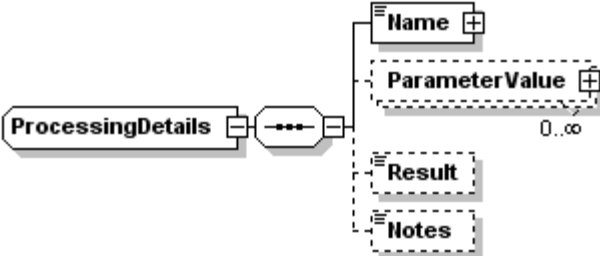
PropertyData contains property data for the phase.

element **PhaseComposition/Notes**

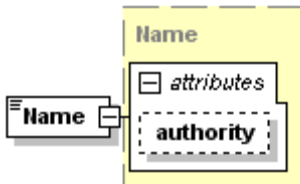
| | |
|------------|---|
| diagram |  |
| type | Notes |
| annotation | Notes contains any additional information concerning the phase. |

A.2.29 ProcessingDetails

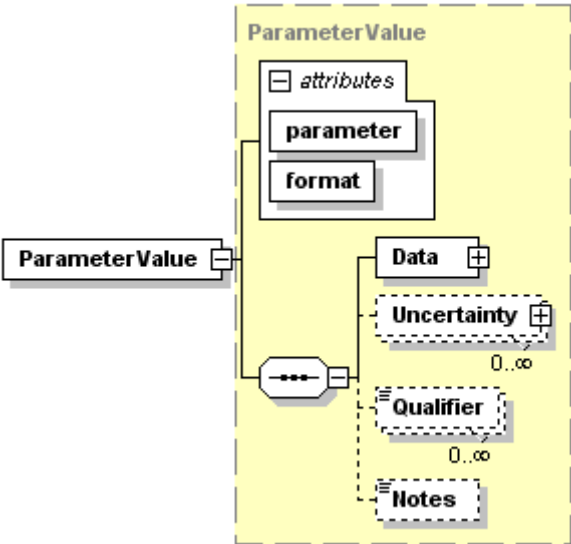
complexType **ProcessingDetails**

| | |
|------------|---|
| diagram |  |
| used by | elements BulkDetails/ProcessingDetails ComponentDetails/ProcessingDetails |
| annotation | Complex-type: containing a description of a processing step for the bulk material or component. |

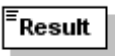
element **ProcessingDetails/Name**

| | | | | | |
|------------|---|------------|----------|--|--|
| diagram |  | | | | |
| type | Name | | | | |
| attributes | Name | Type | Use | Annotation | |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary. | |
| annotation | Name contains the name of the processing step. | | | | |


element **ProcessingDetails/ParameterValue**

| | | | | |
|------------|--|-------------------|----------|--|
| diagram |  | | | |
| type | ParameterValue | | | |
| attributes | Name | Type | Use | Annotation |
| | parameter | xsd:string | required | attribute: parameter references an id attribute specified in a ParameterDetails element in MPRD dictionary. |
| | format | DataFormat | required | attribute: format indicates the format of the value. If used, "mixed" indicates that the not all of the parameter values are of the same type (e.g. a "No Break" value for an otherwise numeric set of test results). If used, then the "format" attribute on each "Data" item should be individually set. |
| annotation | ParameterValue contains the value of a parameter under which the processing step occurred. | | | |

element **ProcessingDetails/Result**

| | |
|------------|---|
| diagram |  |
| type | xsd:string |
| annotation | Result is a string that contains a description of the outcome or result of the processing step. |

element **ProcessingDetails/Notes**

| | |
|------------|---|
| diagram |  |
| type | Notes |
| annotation | Notes contains any additional information concerning the processing step. |

A.2.30 PropertyDatacomplexType **PropertyData**

| | | | | |
|------------|--|---|----------|---|
| diagram | | | | |
| used by | elements | BulkDetails/PropertyData ComponentDetails/PropertyData PhaseComposition/PropertyData | | |
| attributes | Name | Type | Use | Annotation |
| | property | xsd:string | required | attribute: property data id as defined in PropertyDetails section of MPRD_Dictionary. |
| | technique | xsd:string | | attribute: technique id as defined in MeasurementTechniqueDetails section of MPRD_Dictionary. |
| | datasource | xsd:string | | attribute: data source id as defined in DataSourceDetails section of MPRD_Dictionary. |
| | specimen | xsd:string | | attribute: specimen id as defined in SpecimenDetails in the Dictionary element. |
| | test | xsd:string | | attribute: test condition id as defined in TestConditionDetails in Metadata. |
| | delimiter | | | attribute: delimiter specifies the delimiter that separates multiple values in the Data, Qualifier, Uncertainty, and ParameterValue elements. The default value is a comma (','). |
| | quote | xsd:string | | attribute: quote specifies the string that is used to quote values in the Data, Qualifier, Uncertainty and ParameterValue elements. |
| annotation | Complex-type: containing material property data. | | | |

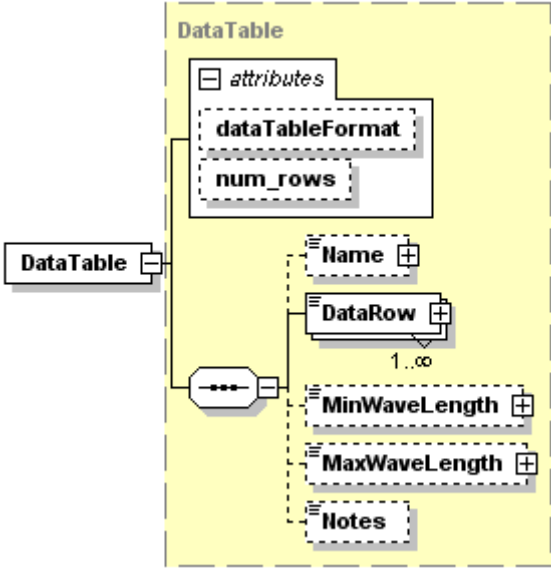
element **PropertyData/Data**

| | | | |
|------------|---------------|--|--|
| diagram | | | |
| type | Data | | |
| annotation | documentation | Data contains property data. Data could be a single value or a series of values separated by delimiters. | |

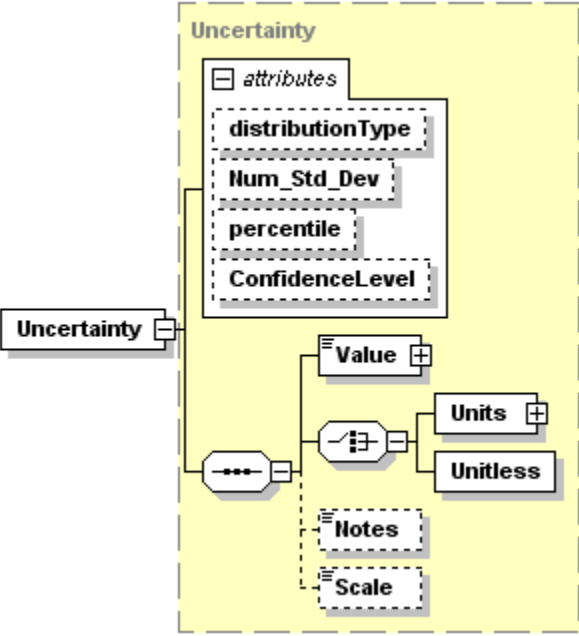
element **PropertyData/DataFile**

| | | | |
|--|--|------------|-----|
| diagram | | | |
| type | DataFile | | |
| attributes | Name | Type | Use |
| | dataFileFormat | xsd:string | |
| Annotation: dataFileFormat is an ID referenced from Global MPRD_Dictionary where the file format is defined. | | | |
| annotation | DataFile contains references to large data tables external to the XML document. This construct can be used for large radiometry data such as per band spectral response. | | |

element **PropertyData/DataTable**

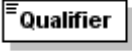
| | | | | |
|------------|---|---------------------|----------|------------|
| diagram |  | | | |
| type | DataTable | | | |
| attributes | Name | Type | Use | Annotation |
| | dataTableFormat | xsd:string | optional | |
| | num_rows | xsd:positiveInteger | optional | |
| annotation | DataTable contains datarows of tabular data within the XML document. This construct can be used for small radiometry data such as per band spectral response. | | | |

element **PropertyData/Uncertainty**

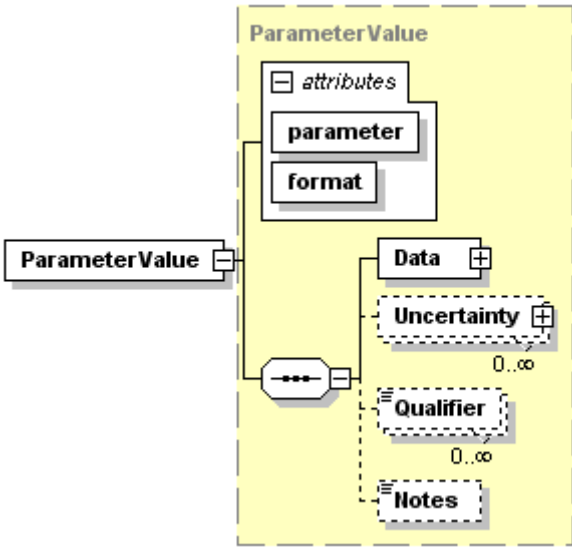
| | | | | |
|---------|---|--|--|--|
| diagram |  | | | |
| type | Uncertainty | | | |

| attributes | Name | Type | Use | Default | Annotation |
|------------|--|-------------------|----------|-----------------|---|
| | distributionType | xsd:string | optional | Normal/Gaussian | attribute: distributionType is a description of the nature of the uncertainty value, for example '6 sigma', 'Gaussian' or '2 std dev.'. |
| | Num_Std_Dev | xsd:float | optional | 2 | |
| | percentile | xsd:float | optional | | attribute: percentile is a value indicating the percentage of the data population that have values less than or equal to that expressed by the Uncertainty value. |
| | ConfidenceLevel | xsd:float | optional | | |
| annotation | Uncertainty contains the measurement uncertainty(ies) of the data in Data element. | | | | |

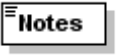
element **PropertyData/Qualifier**

| | |
|------------|---|
| diagram |  |
| type | Qualifier |
| annotation | Qualifier contains any qualifier(s) pertinent to the data in Data (e.g. "min," "max," etc.) and may occur once or not at all within the PropertyData element. |

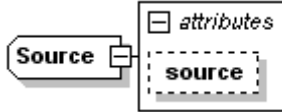
element **PropertyData/ParameterValue**

| diagram |  | | | |
|------------|---|-------------------|----------|--|
| type | ParameterValue | | | |
| attributes | Name | Type | Use | Annotation |
| | parameter | xsd:string | required | attribute: parameter references an id attribute specified in a ParameterDetails element in MPRD dictionary. |
| | format | DataFormat | required | attribute: format indicates the format of the value. If used, "mixed" indicates that the not all of the parameter values are of the same type (e.g. a "No Break" value for an otherwise numeric set of test results). If used, then the "format" attribute on each "Data" item should be individually set. |
| annotation | ParameterValue contains the value(s) of a parameter under which the data were determined. | | | |

element **PropertyData/Notes**

| | |
|------------|---|
| diagram |  |
| type | Notes |
| annotation | documentation Notes contains any additional information concerning the property data. |

A.2.31 SourcecomplexType **Source**

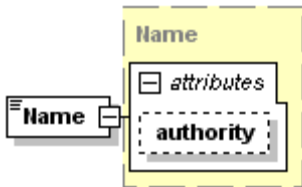
| diagram |  | | | | | | | | | | |
|------------|---|----------|--|-----|------------|--------|-------------------|----------|--|--|--|
| used by | elements BulkDetails/Source ComponentDetails/Source | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>source</td><td>xsd:string</td><td>optional</td><td>attribute: source id as defined in SourceDetails section of MPRD_Dictionary.</td></tr></table> | Name | Type | Use | Annotation | source | xsd:string | optional | attribute: source id as defined in SourceDetails section of MPRD_Dictionary. | | |
| Name | Type | Use | Annotation | | | | | | | | |
| source | xsd:string | optional | attribute: source id as defined in SourceDetails section of MPRD_Dictionary. | | | | | | | | |
| annotation | Complex-type: containing the source provider of data. | | | | | | | | | | |

A.2.32 SpecimenDetailscomplexType **SpecimenDetails**

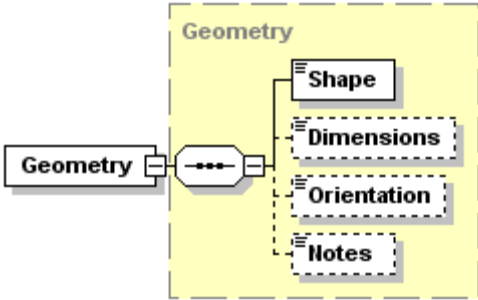
| diagram | | | | | | | | | | | | | |
|------------|--|----------|------------|-----|------------|----|--------|----------|--|------|------------|----------|--|
| used by | element Dictionary/SpecimenDetails | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr><tr><td>type</td><td>xsd:string</td><td>optional</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | | type | xsd:string | optional | |
| Name | Type | Use | Annotation | | | | | | | | | | |
| id | xsd:ID | required | | | | | | | | | | | |
| type | xsd:string | optional | | | | | | | | | | | |
| annotation | <p>Complex-type: containing ids and descriptions of the specimen materials. The specifics include locations, season, geometry, physical states, photos and any notes.</p> <p>SpecimenDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document. delimiter and row data format.</p> <p>Optional attribute "type" specifies the type of the specimen, e.g. "cylindrical," "rectangular," "full cross-section," "pressed,"</p> | | | | | | | | | | | | |

| | |
|--|------|
| | etc. |
|--|------|

element **SpecimenDetails/Name**

| diagram |  <p>The diagram shows a 'Name' element box connected to a dashed box labeled 'Name'. Inside this dashed box are two sub-elements: 'attributes' and 'authority'.</p> | | | | | | | | | | |
|------------|--|----------|--|-----|------------|-----------|------------|----------|--|--|--|
| type | Name | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | |
| Name | Type | Use | Annotation | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | | | | | | |

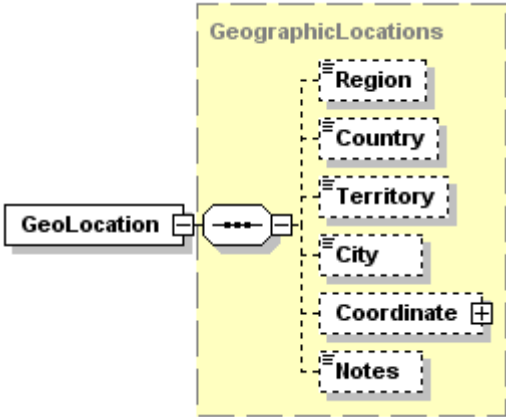
element **SpecimenDetails/Geometry**

| | | | | |
|---------|---|--|--|--|
| diagram |  <p>The diagram shows a 'Geometry' element box connected to a dashed box labeled 'Geometry'. Inside this dashed box are four sub-elements: 'Shape', 'Dimensions', 'Orientation', and 'Notes'.</p> | | | |
| type | Geometry | | | |

element **SpecimenDetails/GeoInfo**

| | | | | |
|---------|--|--|--|--|
| diagram |  <p>The diagram shows a 'GeoInfo' element box connected to a dashed box labeled 'GeoLocation' with a plus sign in the top right corner.</p> | | | |
|---------|--|--|--|--|

element **SpecimenDetails/GeoInfo/GeoLocation**


| | | | | |
|---------|---|--|--|--|
| diagram |  <p>The diagram shows a 'GeoLocation' element box connected to a dashed box labeled 'GeographicLocations'. Inside this dashed box are five sub-elements: 'Region', 'Country', 'Territory', 'City', and 'Coordinate' (with a plus sign in the top right corner), and 'Notes'.</p> | | | |
|---------|---|--|--|--|

| | |
|------|---------------------|
| type | GeographicLocations |
|------|---------------------|

element **SpecimenDetails/State**

| | |
|---------|---|
| diagram |  The diagram shows a box labeled 'State' connected by a line with three dots to a dashed box containing 'Season' and 'Phase' stacked vertically. |
|---------|---|

element **SpecimenDetails/State/Season**

| | | | | | | | | | | | |
|-------------|---|-------------|--------|-------------|--------|-------------|--------|-------------|--------|-------------|--|
| diagram |  The diagram shows a box labeled 'Season'. | | | | | | | | | | |
| type | restriction of xsd:string | | | | | | | | | | |
| facets | <table><tr><td>enumeration</td><td>Spring</td></tr><tr><td>enumeration</td><td>Summer</td></tr><tr><td>enumeration</td><td>Autumn</td></tr><tr><td>enumeration</td><td>Winter</td></tr><tr><td>enumeration</td><td></td></tr></table> | enumeration | Spring | enumeration | Summer | enumeration | Autumn | enumeration | Winter | enumeration | |
| enumeration | Spring | | | | | | | | | | |
| enumeration | Summer | | | | | | | | | | |
| enumeration | Autumn | | | | | | | | | | |
| enumeration | Winter | | | | | | | | | | |
| enumeration | | | | | | | | | | | |

element **SpecimenDetails/State/Phase**

| | |
|---------|---|
| diagram |  The diagram shows a box labeled 'Phase'. |
| type | xsd:string |

element **SpecimenDetails/Photo**

| | |
|---------|--|
| diagram |  The diagram shows a box labeled 'Photo'. |
|---------|--|

element **SpecimenDetails/Notes**


| | |
|---------|--|
| diagram |  The diagram shows a box labeled 'Notes'. |
| type | Notes |

A.2.33 Term

complexType **Term**

| | |
|---------|--|
| diagram | |
| used by | element MPRD_Doc/Glossary/Terms |

element **Term/Name**

| | | | | |
|------------|---|------------|----------|--|
| diagram |  | | | |
| type | Name | | | |
| attributes | Name | Type | Use | Annotation |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. |

element **Term/Definition**

| | |
|---------|------------|
| diagram | |
| type | xsd:string |

element **Term/Abbreviation**

| | |
|---------|------------|
| diagram | |
| type | xsd:string |

element **Term/Synonym**

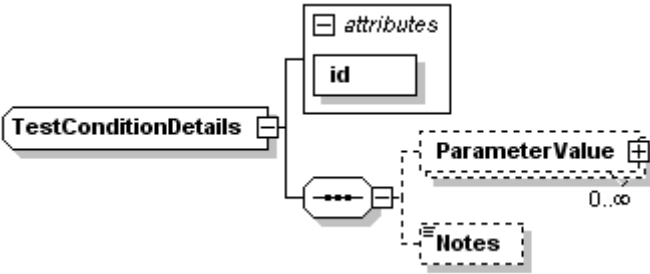
| | |
|---------|------------|
| diagram | |
| type | xsd:string |

element **Term/Notes**

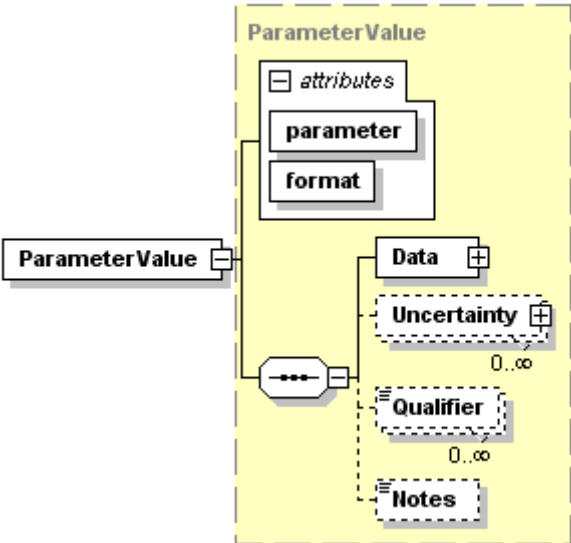
| | |
|---------|---|
| diagram |  |
| type | Notes |

A.2.34 TestConditionDetails

complexType **TestConditionDetails**

| | | | | |
|------------|--|--|----------|------------|
| diagram |  | | | |
| used by | element | Dictionary/TestConditionDetails | | |
| attributes | Name | Type | Use | Annotation |
| | id | xsd:ID | required | |
| annotation | Complex-type:containing a description of the test conditions referenced by the PropertyData element. | | | |

element **TestConditionDetails/ParameterValue**

| | | | | |
|------------|---|-------------------|----------|---|
| diagram |  | | | |
| type | ParameterValue | | | |
| attributes | Name | Type | Use | Annotation |
| | parameter | xsd:string | required | attribute: parameter references an id attribute specified in a ParameterDetails element in MPRD dictionary. |
| | format | DataFormat | required | attribute: format indicates the format of the value. If used, "mixed" indicates that the not all of the parameter values are of the same type (e.g. a "No Break" value for an otherwise numeric set of test results). If used, then the |

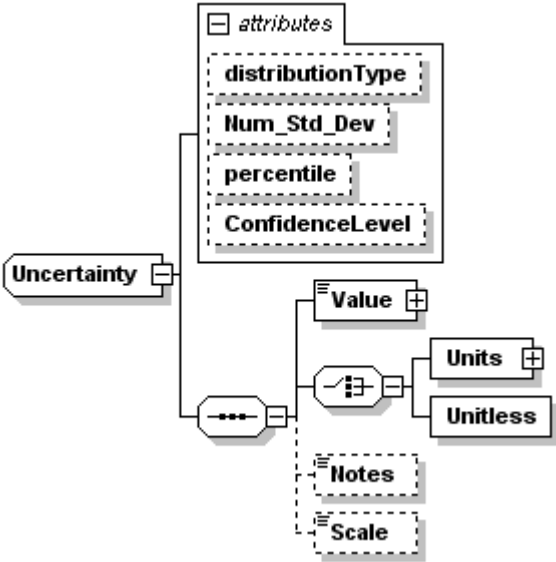
| | | | | |
|--|--|--|--|--|
| | | | | "format" attribute on each "Data" item should be individually set. |
|--|--|--|--|--|

element **TestConditionDetails/Notes**

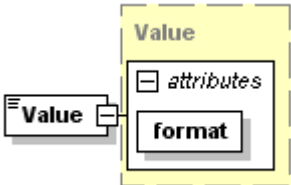
| | |
|---------|---|
| diagram |  |
| type | Notes |

A.2.35 Uncertainty

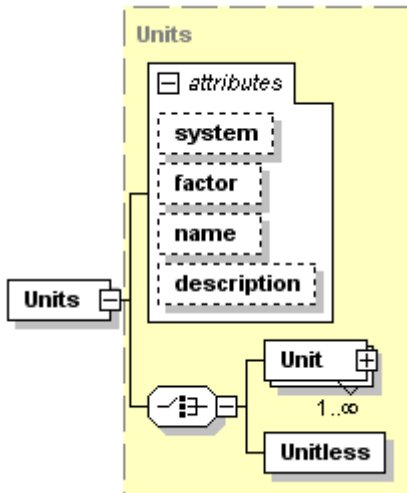
complexType **Uncertainty**

| | | | | | |
|------------|--|--|----------|-----------------|---|
| diagram |  | | | | |
| used by | elements | Concentration/Uncertainty DimensionalDetails/Uncertainty ParameterValue/Uncertainty PropertyData/Uncertainty | | | |
| attributes | Name | Type | Use | Default | Annotation |
| | distributionType | xsd:string | optional | Normal/Gaussian | attribute: distributionType is a description of the nature of the uncertainty value, for example '6 sigma', 'Gaussian' or '2 std dev.' |
| | Num_Std_Dev | xsd:float | optional | 2 | |
| | percentile | xsd:float | optional | | attribute: percentile is a value indicating the percentage of the data population that have values less than or equal to that expressed by the Uncertainty value. |
| | ConfidenceLevel | xsd:float | optional | | |
| annotation | ComplexType: containing a description of the measurement uncertainty of the data. An uncertainty of 2 standard deviations below the mean for a normally distributed dataset would have a uncertainty percentile of 5%, and 2 standard deviations above the mean would be 95%. | | | | |

element **Uncertainty/Value**

| | | | | | | |
|------------|---|-------------------|----------|---------|-------|------------|
| diagram |  | | | | | |
| type | Value | | | | | |
| attributes | Name | Type | Use | Default | Fixed | Annotation |
| | format | DataFormat | required | | | |
| annotation | Value contains the value of the uncertainty. | | | | | |

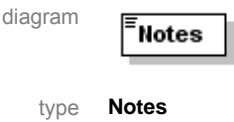
element **Uncertainty/Units**

| diagram |  | | | | | | | | | | | | | | | | | | | | |
|-------------|---|------|---|-----|------------|--------|-------------------|--|---|--------|------------------|--|---|------|-------------------|--|---|-------------|-------------------|--|---|
| type | Units | | | | | | | | | | | | | | | | | | | | |
| attributes | <table><thead><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr></thead><tbody><tr><td>system</td><td>xsd:string</td><td></td><td>attribute: system is used to indicate the units system, such as "SI."</td></tr><tr><td>factor</td><td>xsd:float</td><td></td><td>attribute: factor is used to indicate a constant multiplier in floating point format.</td></tr><tr><td>name</td><td>xsd:string</td><td></td><td>attribute: name is used to indicate the name of the units. For example: "m/s"</td></tr><tr><td>description</td><td>xsd:string</td><td></td><td>attribute: description is used to describe the units. For example: "meter per second"</td></tr></tbody></table> | Name | Type | Use | Annotation | system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." | factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. | name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s" | description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second" |
| Name | Type | Use | Annotation | | | | | | | | | | | | | | | | | | |
| system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." | | | | | | | | | | | | | | | | | | |
| factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. | | | | | | | | | | | | | | | | | | |
| name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s" | | | | | | | | | | | | | | | | | | |
| description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second" | | | | | | | | | | | | | | | | | | |
| annotation | Units contains the units for the value of the uncertainty. | | | | | | | | | | | | | | | | | | | | |

element **Uncertainty/Unitless**

| | | | | | | |
|---------|---|--|--|--|--|--|
| diagram |  | | | | | |
| type | Unitless | | | | | |

element **Uncertainty/Notes**



element **Uncertainty/Scale**


| | | | |
|---------|----------------------------------|-------------|--|
| diagram | | | |
| type | restriction of xsd:string | | |
| facets | enumeration | Linear | |
| | enumeration | Logarithmic | |

A.2.36 Unit

complexType **Unit**

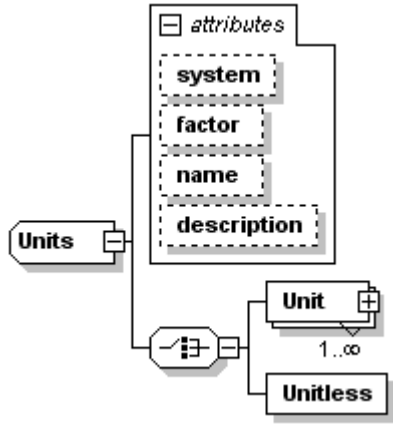
| | | | | |
|------------|--|--------------------|----------|---|
| diagram | | | | |
| used by | element Units/Unit | | | |
| attributes | Name | Type | Use | Annotation |
| | name | | required | unit abbreviation. For example "s" for seconds |
| | power | xsd:decimal | | attribute: power is used to indicate the exponent for Unit. |
| | description | xsd:string | | attribute: description is used to describe Unit. For example "Seconds". |
| annotation | Complex-type: containing unit definitions. | | | |

complexType **Unitless**

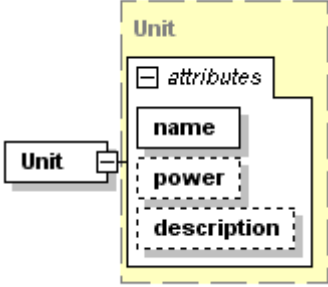
| | | | |
|------------|---|--|--|
| diagram |  | | |
| used by | elements | Data/Unitless Uncertainty/Unitless Units/Unitless | |
| annotation | Complex-type: declaring the element value has no unit. | | |

A.2.37 Units

complexType Units

| | | | | |
|------------|---|---|-----|--|
| diagram |  | | | |
| used by | elements | Concentration/Units Data/Units DimensionalDetails/Units Uncertainty/Units | | |
| attributes | Name | Type | Use | Annotation |
| | system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." |
| | factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. |
| | name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s". |
| | description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second". |
| annotation | Complex-type: containing unit definitions. Example: <Units system="SI" name="W/m-K" description="watt per meter Kelvin "> <Unit name="W" power="1" description="watt"/> <Unit name="m" power="-1" description="meter"/> <Unit name="K" power="-1" description="Kelvin"/> </Units> | | | |

element Units/Unit

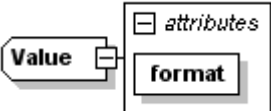
| | | | | |
|------------|---|-------------|----------|---|
| diagram |  | | | |
| type | Unit | | | |
| attributes | Name | Type | Use | Annotation |
| | name | | required | unit abbreviation. For example "s" for seconds. |
| | power | xsd:decimal | | attribute: power is used to indicate the exponent for Unit. |
| | description | xsd:string | | attribute: description is used to describe Unit. For example "Seconds". |
| annotation | Multiple Unit elements are multiplied together to form the units. Division is specified by using setting the power attribute of Unit equal to "-1." | | | |

element **Units/Unitless**

| | |
|---------|---|
| diagram |  |
| type | Unitless |

A.2.38 Value

complexType **Value**

| | | | | | | |
|------------|---|-------------------|----------|---------|-------|------------|
| diagram |  | | | | | |
| type | extension of xsd:string | | | | | |
| used by | elements Concentration/Value Data/Value DimensionalDetails/Value Uncertainty/Value | | | | | |
| attributes | Name | Type | Use | Default | Fixed | Annotation |
| | format | DataFormat | required | | | |
| annotation | Complex-type: containing a string representing a value. | | | | | |

A.3 MPRD Doc Simple Types

A.3.1 ChemicalElementSymbol

simpleType **ChemicalElementSymbol**

| type | restriction of xsd:string | |
|---------|----------------------------------|-----------------------|
| used by | element | Element/Symbol |
| facets | enumeration | H |
| | enumeration | He |
| | enumeration | Li |
| | enumeration | Be |
| | enumeration | B |
| | enumeration | C |
| | enumeration | N |
| | enumeration | O |
| | enumeration | F |
| | enumeration | Ne |
| | enumeration | Na |
| | enumeration | Mg |
| | enumeration | Al |
| | enumeration | Si |
| | enumeration | P |
| | enumeration | S |
| | enumeration | Cl |
| | enumeration | Ar |
| | enumeration | K |
| | enumeration | Ca |
| | enumeration | Sc |
| | enumeration | Ti |
| | enumeration | V |
| | enumeration | Cr |
| | enumeration | Mn |
| | enumeration | Fe |
| | enumeration | Co |
| | enumeration | Ni |
| | enumeration | Cu |
| | enumeration | Zn |
| | enumeration | Ga |
| | enumeration | Ge |
| | enumeration | As |
| | enumeration | Se |
| | enumeration | Br |
| | enumeration | Kr |
| | enumeration | Rb |
| | enumeration | Sr |
| | enumeration | Y |
| | enumeration | Zr |
| | enumeration | Nb |
| | enumeration | Mo |
| | enumeration | Tc |
| | enumeration | Ru |
| | enumeration | Rh |
| | enumeration | Pd |
| | enumeration | Ag |
| | enumeration | Cd |
| | enumeration | In |
| | enumeration | Sn |
| | enumeration | Sb |
| | enumeration | Te |
| | enumeration | I |
| | enumeration | Xe |
| | enumeration | Cs |

| | | |
|------------|--|-----|
| | enumeration | Ba |
| | enumeration | La |
| | enumeration | Ce |
| | enumeration | Pr |
| | enumeration | Nd |
| | enumeration | Pm |
| | enumeration | Sm |
| | enumeration | Eu |
| | enumeration | Gd |
| | enumeration | Tb |
| | enumeration | Dy |
| | enumeration | Ho |
| | enumeration | Er |
| | enumeration | Tm |
| | enumeration | Yb |
| | enumeration | Lu |
| | enumeration | Hf |
| | enumeration | Ta |
| | enumeration | W |
| | enumeration | Re |
| | enumeration | Os |
| | enumeration | Ir |
| | enumeration | Pt |
| | enumeration | Au |
| | enumeration | Hg |
| | enumeration | Tl |
| | enumeration | Pb |
| | enumeration | Bi |
| | enumeration | Po |
| | enumeration | At |
| | enumeration | Rn |
| | enumeration | Fr |
| | enumeration | Ra |
| | enumeration | Ac |
| | enumeration | Th |
| | enumeration | Pa |
| | enumeration | U |
| | enumeration | Np |
| | enumeration | Pu |
| | enumeration | Am |
| | enumeration | Cm |
| | enumeration | Bk |
| | enumeration | Cf |
| | enumeration | Es |
| | enumeration | Fm |
| | enumeration | Md |
| | enumeration | No |
| | enumeration | Lr |
| | enumeration | Rf |
| | enumeration | Db |
| | enumeration | Sg |
| | enumeration | Bh |
| | enumeration | Hs |
| | enumeration | Mt |
| | enumeration | Uun |
| | enumeration | Uuu |
| | enumeration | Uub |
| | enumeration | Uuq |
| | enumeration | Uuh |
| | enumeration | Uuo |
| annotation | Simple-type: enumerates the valid strings representing chemical elements, which may be used in the Symbol element. | |

A.3.2 DataFormatsimpleType **DataFormat**

| | | |
|------------|--|---|
| type | restriction of xsd:string | |
| used by | attributes | DataFile/MinWaveLength/@format DataFile/MaxWaveLength/@format DataTable/MinWaveLength/@format DataTable/MaxWaveLength/@format ParameterValue/@format Value/@format |
| facets | enumeration | float |
| | enumeration | integer |
| | enumeration | string |
| | enumeration | exponential |
| | enumeration | mixed |
| annotation | DataFormat defines a simple type for element values. It is enumerated with "float," "integer," "string," "exponential" and "mixed". "mixed" is only used for a group of data where each individual member of the group can be given a unique format. | |

A.3.3 FormulasimpleType **Formula**

| | | |
|------------|--|---------------------------------|
| type | xsd:string | |
| used by | element | Characterization/Formula |
| annotation | Simple-type:containing a string representation of the chemical formula for the bulk material or component. | |

A.3.4 GeoRegionssimpleType **GeoRegions**

| | | |
|------------|--|-----------------------------------|
| type | restriction of xsd:string | |
| used by | element | GeographicLocations/Region |
| facets | enumeration | Oceans |
| | enumeration | North America |
| | enumeration | Central America |
| | enumeration | South America |
| | enumeration | Europe |
| | enumeration | Africa |
| | enumeration | Australia and New Zealand |
| | enumeration | Antarctica |
| | enumeration | Asia |
| | enumeration | Asia Minor and Middle East |
| | enumeration | Southeast Asia |
| | enumeration | Other |
| annotation | simple-type: enumerates main geographic regions. | |

A.3.5 NotessimpleType **Notes**

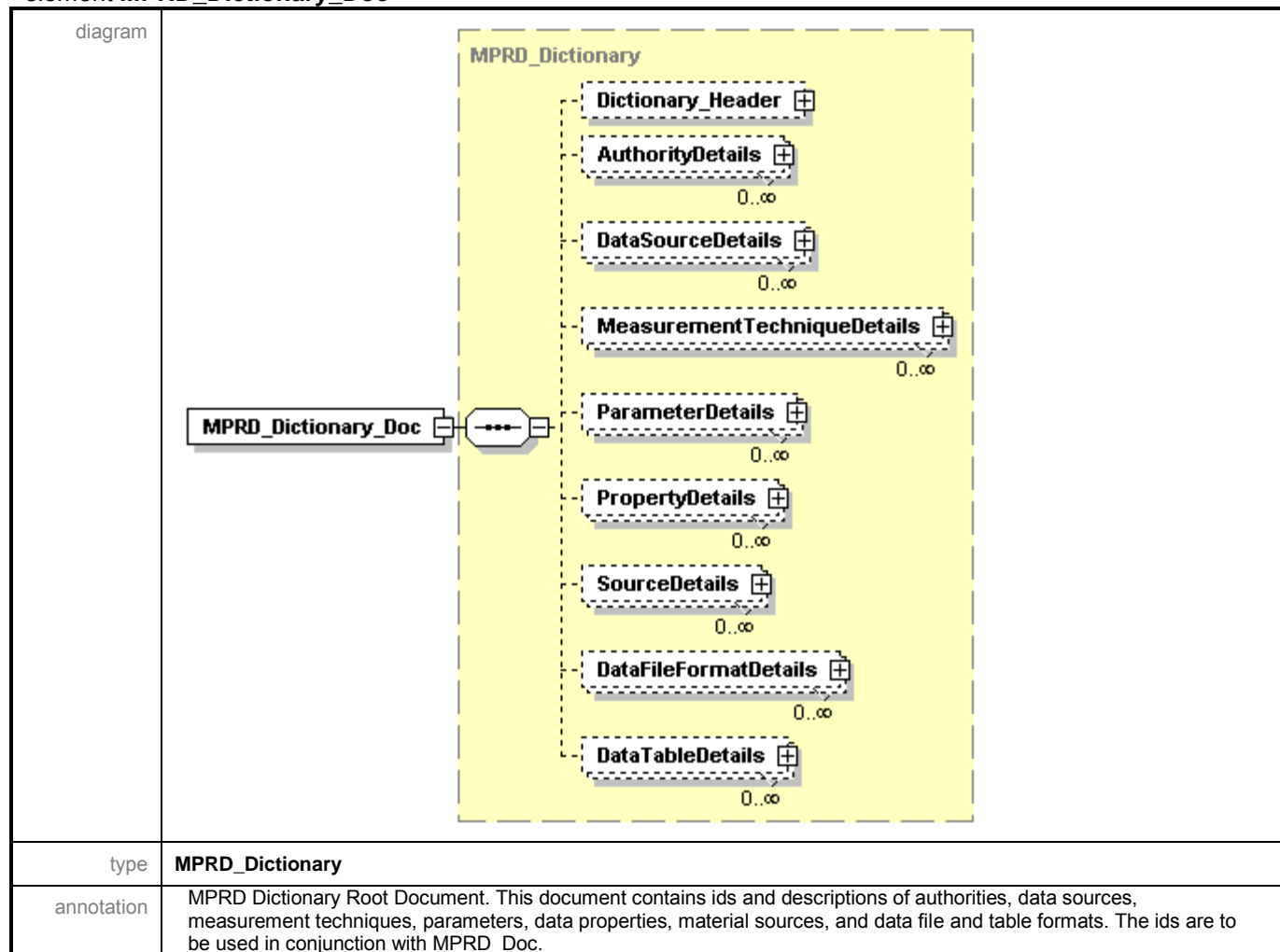
| | | |
|------------|--|---|
| type | xsd:string | |
| used by | elements | Term/Notes Uncertainty/Notes TestConditionDetails/Notes SpecimenDetails/Notes PropertyData/Notes ProcessingDetails/Notes PhaseComposition/Notes ParameterValue/Notes GlossaryTerm/Notes Geometry/Notes GeographicLocations/Notes Form/Notes Element/Notes DimensionalDetails/Notes DataTable/Notes DataFile/Notes Data/Notes Concentration/Notes Compound/Notes ComponentDetails/Notes Characterization/Notes BulkDetails/Notes AssociationDetails/Notes |
| annotation | Simple-type: containing a string representing descriptive notes. | |

A.3.6 Qualifier

simpleType **Qualifier**

| | |
|------------|---|
| type | xsd:string |
| used by | elements Concentration/Qualifier ParameterValue/Qualifier PropertyData/Qualifier |
| annotation | Simple-type: containing string representing a qualifier. |

A.4 MPRD Dictionary Doc Elements

element **MPRD_Dictionary_Doc**

Dictionary_Header is the document header containing document title, revision history, and other administrative information (contact info, licensing, security, etc.).

AuthorityDetails element contains the details for each authority id that may be referenced by any MPRD Document. Authority is a person or an organization that defines the name, terms, or nomenclature used in the MPRD.

DataSourceDetails element contains the details for each data source id that may be referenced by any MPRD Document. Data source is a person or an organization provides a particular material property data per property in a material.

MeasurementTechnique element contains the details for each measurement technique id that may be referenced by any MPRD Document. Measurement technique is a description of a method used in measuring the property data.

ParameterDetails element contains the details for each parameter id that may be referenced by any MPRD Document. Parameter is a measured environmental condition

under which the property data is being measured. Parameter examples would be temperature, pressure, elevation, etc.

PropertyDetails element contains the details for each property id that may be referenced by any MPRD Document. Property is the measured/quantified behavior of the material under a given parameter condition. Property examples would be reflectivity, thermal conductivity, specific gravity, etc.

SourceDetails element contains the details for each source id that may be referenced by any MPRD Document. Source is a person or organization that provides the material property for each material in a MPRD Document.

DataFileFormatDetails element contains the details for each data file format id that may be referenced by any MPRD Document. Data file format describes the format of a data file so the data can be read and loaded for use. Large tables of radiometry (spectral) data for a material may be tabulated in a separate file, such as ASCII or binary file.

DataTableDetails element contains the details for each data table id that may be referenced by any MPRD Document. Data table describes the format of a table so the data can be read and loaded for use. Small and medium tables of radiometry (spectral) data for a material may be tabulated internally within a MPRD Document.

A.5 MPRD Dictionary Doc Complex Types

A.5.1 AuthorityDetails

complexType **AuthorityDetails**

| diagram | | | | | | | | | | | | |
|------------|--|----------|------------|-----|------------|----|--------|----------|--|--|--|--|
| used by | element MPRD_Dictionary/AuthorityDetails | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| id | xsd:ID | required | | | | | | | | | | |
| annotation | <p>Complex-type: AuthorityDetails contains ids and descriptions of authorities (usually organizations) referenced by attribute "authority" of complex datatype "Name" in MPRD schema.</p> <p>AuthorityDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>Name contains the name of the Authority defined under the authority.</p> <p>Notes contains any additional information concerning the Authority.</p> | | | | | | | | | | | |

element **AuthorityDetails/Name**

| diagram | | | | | | | | | | | | |
|------------|---|----------|--|-----|------------|-----------|------------|----------|--|--|--|--|
| type | Name | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | | | | | | | |

element **AuthorityDetails/Notes**

| | | | | |
|---------|--------------|--|--|--|
| diagram | | | | |
| type | Notes | | | |


A.5.2 DataFileFormatDetailscomplexType **DataFileFormatDetails**

| diagram | | | | | | | | | |
|------------|--|----------|------------|-----|------------|----|--------|----------|--|
| used by | element MPRD_Dictionary/DataFileFormatDetails | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | |
| Name | Type | Use | Annotation | | | | | | |
| id | xsd:ID | required | | | | | | | |
| annotation | <p>Complex-type: DataFileFormatDetails contains ids and descriptions of data files referenced by attribute "dataFileFormat" of complex type "DataFile" in MPRD schema.</p> <p>DataFileFormatDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>ASCII element defines format for ASCII files. It defines the header labels of the tabular data, the corresponding units for the header labels, the row data delimiter and row data format.</p> <p>Application element defines format based on file types. It defines the header labels of the tabular data, the corresponding units for the header labels, the row data format.</p> <p>Binary element defines format for Binary files. It defines the header and record byte size, and data definition per record, record and file tokens in HEX.</p> <p>Notes contains any additional information concerning the data file format.</p> | | | | | | | | |


element **DataFileFormatDetails/ASCII**

| diagram | | | | | | | | | | | | |
|------------|--|----------|------------|-----|------------|-----------|------------|----------|--|--|--|--|
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>delimiter</td><td>xsd:string</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | delimiter | xsd:string | required | | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| delimiter | xsd:string | required | | | | | | | | | | |
| annotation | <p>Definition for ASCII text file type file including CSV file. Typically the file has several lines of header to be skipped. The data is arranged in columns and separated by "delimiter" character such as ",", ";", "tab", etc.</p> <p>The "ColumnLabels" is a list of text labels that define the table. Use "delimiter" character between labels. For example: "WaveLength","Reflectivity".</p> | | | | | | | | | | | |

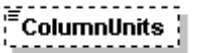
element **DataFileFormatDetails/ASCII/HeaderToSkip**

| | |
|---------|---|
| diagram |  |
| type | xsd:integer |

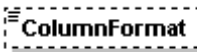
element **DataFileFormatDetails/ASCII/ColumnLabels**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

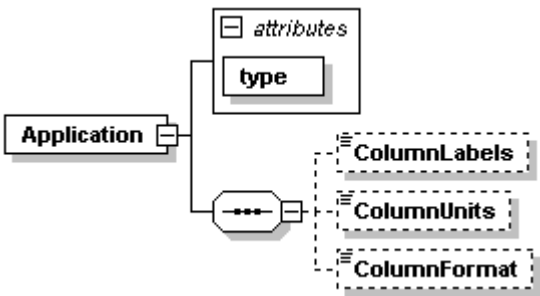
element **DataFileFormatDetails/ASCII/ColumnUnits**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

element **DataFileFormatDetails/ASCII/ColumnFormat**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

element **DataFileFormatDetails/Application**

| | | | | | | |
|------------|---|---------------------------|----------|---------|-------|------------|
| diagram |  | | | | | |
| attributes | Name | Type | Use | Default | Fixed | Annotation |
| | type | derived by: xsd:string | required | | | |
| annotation | Definition for known "Application" file such as XLS or DBF data files. | | | | | |

element **DataFileFormatDetails/Application/ColumnLabels**


| | |
|---------|---|
| diagram |  |
|---------|---|

| | |
|------|------------|
| type | xsd:string |
|------|------------|

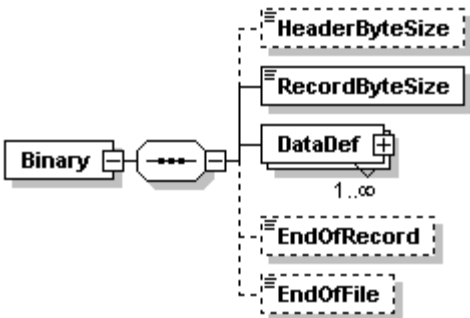
element **DataFileFormatDetails/Application/ColumnUnits**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

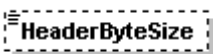
element **DataFileFormatDetails/Application/ColumnFormat**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |


element **DataFileFormatDetails/Binary**

| | |
|------------|--|
| diagram |  |
| annotation | <p>Definition for "Binary" data files. A record consists of a group of data. For example, a record would contain a pair of wavelength and reflectivity values.</p> <p>"DataType" is to specify the numerical representative of the data. For example "float", "integer".</p> |

element **DataFileFormatDetails/Binary/HeaderByteSize**

| | |
|---------|---|
| diagram |  |
| type | xsd:integer |

element **DataFileFormatDetails/Binary/RecordByteSize**

| | |
|---------|---|
| diagram |  |
| type | xsd:integer |

element **DataFileFormatDetails/Binary/DataDef**element **DataFileFormatDetails/Binary/DataDef/DataLabel**

| | |
|---------|------------|
| diagram | |
| type | xsd:string |

element **DataFileFormatDetails/Binary/DataDef/DataUnit**

| | |
|---------|------------|
| diagram | |
| type | xsd:string |

element **DataFileFormatDetails/Binary/DataDef/DataType**

| | | | | | | | | | | | |
|-------------|---|-------------|-------|-------------|---------|-------------|--------------|-------------|------|-------------|---------------|
| diagram | | | | | | | | | | | |
| type | restriction of xsd:string | | | | | | | | | | |
| facets | <table border="1"> <tr><td>enumeration</td><td>FLOAT</td></tr> <tr><td>enumeration</td><td>INTEGER</td></tr> <tr><td>enumeration</td><td>UNSIGNED_INT</td></tr> <tr><td>enumeration</td><td>LONG</td></tr> <tr><td>enumeration</td><td>UNSIGNED_LONG</td></tr> </table> | enumeration | FLOAT | enumeration | INTEGER | enumeration | UNSIGNED_INT | enumeration | LONG | enumeration | UNSIGNED_LONG |
| enumeration | FLOAT | | | | | | | | | | |
| enumeration | INTEGER | | | | | | | | | | |
| enumeration | UNSIGNED_INT | | | | | | | | | | |
| enumeration | LONG | | | | | | | | | | |
| enumeration | UNSIGNED_LONG | | | | | | | | | | |

element **DataFileFormatDetails/Binary/DataDef/DataByteSize**

| | |
|---------|-------------|
| diagram | |
| type | xsd:integer |

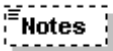
element **DataFileFormatDetails/Binary/EndOfRecord**

| | |
|---------|------------|
| diagram | |
| type | xsd:string |

element **DataFileFormatDetails/Binary/EndOfFile**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

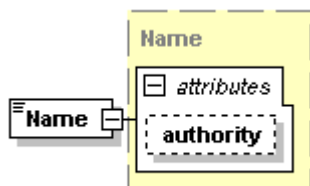
element **DataFileFormatDetails/Notes**

| | |
|---------|---|
| diagram |  |
| type | Notes |

A.5.3 DataSourceDetailscomplexType **DataSourceDetails**

| diagram | | | | | | | | | | | | | | | | |
|------------|---|----------|------------|-----|------------|----|---------------|----------|--|------|-------------------|----------|--|--|--|--|
| used by | element MPRD_Dictionary/DataSourceDetails | | | | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr><tr><td>type</td><td>xsd:string</td><td>optional</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | | type | xsd:string | optional | | | | |
| Name | Type | Use | Annotation | | | | | | | | | | | | | |
| id | xsd:ID | required | | | | | | | | | | | | | | |
| type | xsd:string | optional | | | | | | | | | | | | | | |
| annotation | <p>Complex-type: DataSourceDetails contains ids and descriptions of data sources (usually organizations) referenced by attribute "datasource" of complex datatype "PropertyData" in MPRD schema.</p> <p>DataSourceDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>DataSourceDetails also has one optional attribute, type, for specifying the type of the data source (examples include "unpublished report," "journal," "handbook," etc.).</p> <p>Name contains the name of the data source defined under the authority.</p> <p>Notes contains any additional information concerning the data source.</p> | | | | | | | | | | | | | | | |

element **DataSourceDetails/Name**

| | | | | | |
|------------|---|------------|----------|--|--|
| diagram |  | | | | |
| type | Name | | | | |
| attributes | Name | Type | Use | Annotation | |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary. | |

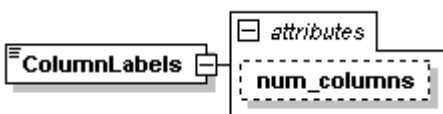
element **DataSourceDetails/Notes**

| | |
|---------|---|
| diagram |  |
| type | Notes |

A.5.4 DataTableDetailscomplexType **DataTableDetails**

| diagram | | | | | | | | | | | | | |
|------------|---|----------|------------|-----|------------|----|---------------|----------|--|--|--|--|--|
| used by | element MPRD_Dictionary/DataTableDetails | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | | | | | |
| Name | Type | Use | Annotation | | | | | | | | | | |
| id | xsd:ID | required | | | | | | | | | | | |
| annotation | <p>Complex-type: DataTableDetails contains ids and descriptions of data tables referenced by attribute "dataTableFormat" of complex type "DataTable" in MPRD schema.</p> <p>DataTableDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>It defines the header labels of the tabular data, the corresponding units for the header labels, and the row data format.</p> | | | | | | | | | | | | |

element **DataTableDetails/ColumnLabels**

| diagram |  | | | | | | | | | | | |
|-------------|---|----------|------------|-----|------------|-------------|--------------------|----------|--|--|--|--|
| type | extension of xsd:string | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>num_columns</td><td>xsd:integer</td><td>optional</td><td></td></tr></table> | Name | Type | Use | Annotation | num_columns | xsd:integer | optional | | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| num_columns | xsd:integer | optional | | | | | | | | | | |

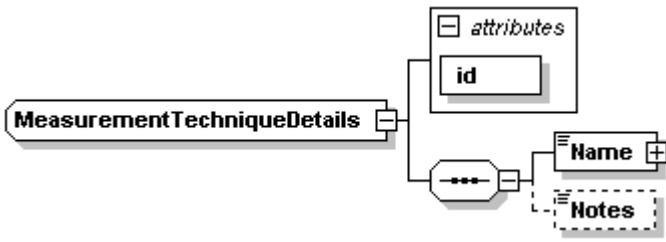
element **DataTableDetails/ColumnUnits**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

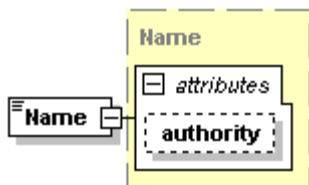
element **DataTableDetails/ColumnFormat**

| | |
|---------|---|
| diagram |  |
| type | xsd:string |

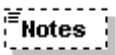
A.5.5 MeasurementTechniqueDetailscomplexType **MeasurementTechniqueDetails**

| diagram |  | | | | | | | | | | | |
|------------|---|----------|------------|-----|------------|----|--------|----------|--|--|--|--|
| used by | element MPRD_Dictionary/MeasurementTechniqueDetails | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| id | xsd:ID | required | | | | | | | | | | |
| annotation | <p>Complex-type: MeasurementTechniqueDetails contains ids and descriptions of measurement techniques referenced by attribute "technique" of complex datatype "PropertyData" in MPRD schema.</p> <p>MeasurementTechniqueDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>Name contains the name of the measurement technique defined under the authority.</p> <p>Notes contains any additional information concerning the measurement technique.</p> | | | | | | | | | | | |

element **MeasurementTechniqueDetails/Name**

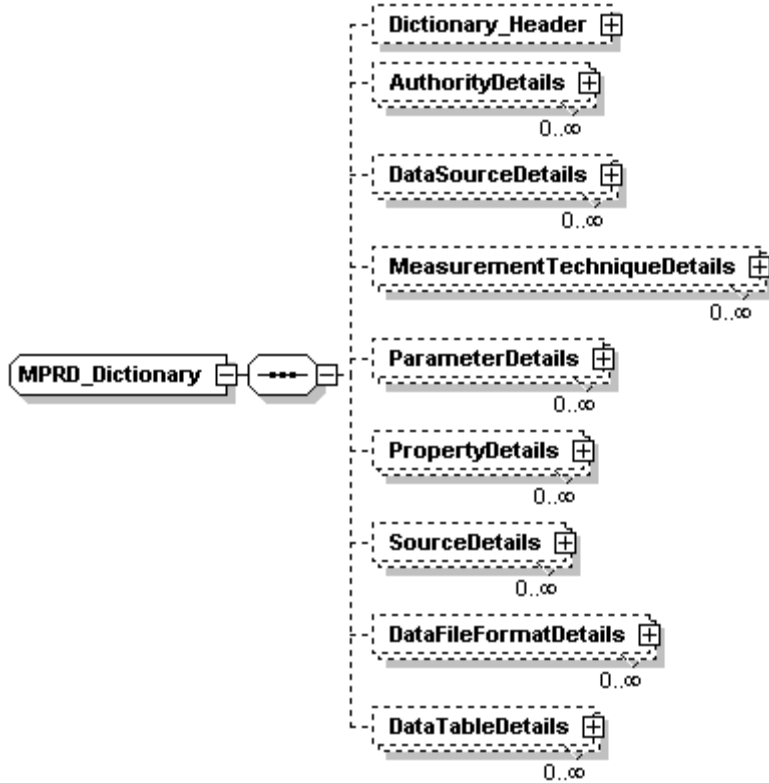
| diagram |  | | | | | | | | | | | |
|------------|---|----------|--|-----|------------|-----------|------------|----------|--|--|--|--|
| type | Name | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD Dictionary. | | | | | | | | | |

element **MeasurementTechniqueDetails/Notes**

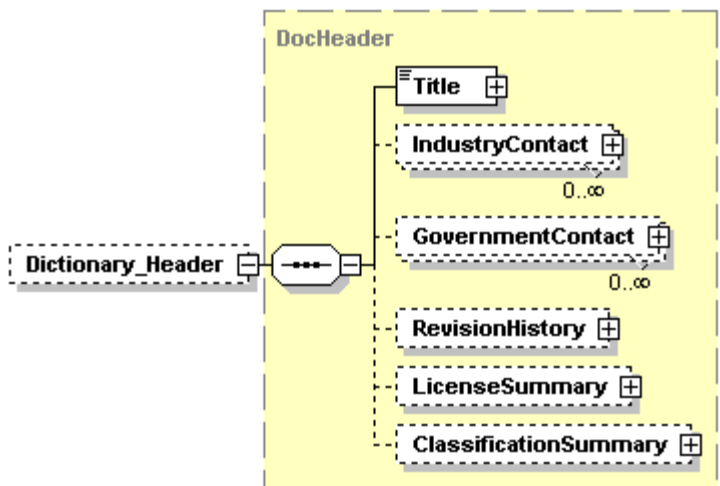
| | | | | |
|---------|---|--|--|--|
| diagram |  | | | |
| type | Notes | | | |

A.5.6 MPRD Dictionary

complexType **MPRD_Dictionary**

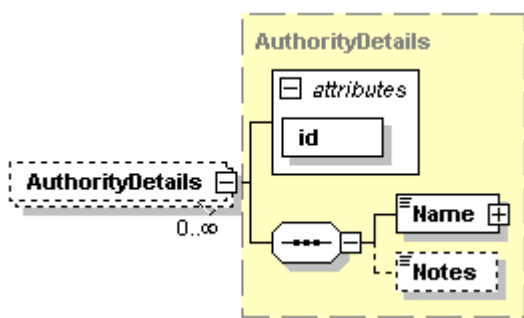
| | |
|------------|--|
| diagram |  |
| used by | element MPRD_Dictionary_Doc |
| annotation | Complex-type: MPRD_Dictionary is the main complex datatype for MPRD dictionary document. |

element **MPRD_Dictionary/Dictionary_Header**

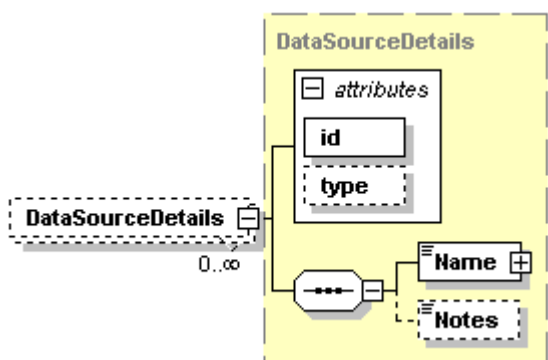
| | |
|---------|--|
| diagram |  |
| type | DocHeader |

| | |
|------------|---|
| annotation | MPRD Dictionary administrative information. |
|------------|---|

element **MPRD_Dictionary/AuthorityDetails**

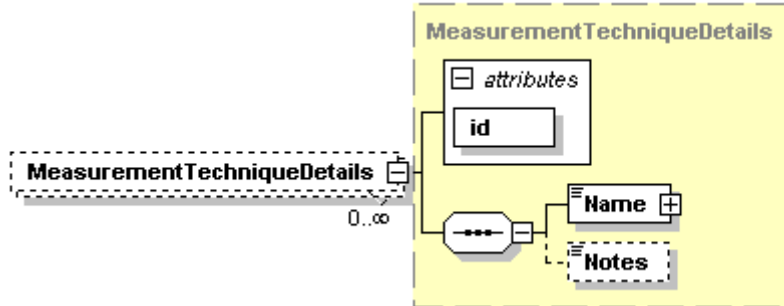
| | | | | |
|------------|--|--------|----------|------------|
| diagram |  | | | |
| type | AuthorityDetails | | | |
| attributes | Name | Type | Use | Annotation |
| | id | xsd:ID | required | |
| annotation | <p>AuthorityDetails contains ids and descriptions of authorities (usually organizations) referenced by attribute "authority" of complex datatype "Name" in MPRD schema.</p> <p>AuthorityDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>Name contains the name of the Authority defined under the authority.</p> <p>Notes contains any additional information concerning the Authority.</p> <p>Example:</p> <pre><AuthorityDetails id="Auth6"> <Name>FEIS</Name> <Notes>Fire Effects Information System (USDA forest service)</Notes> </AuthorityDetails></pre> | | | |

element **MPRD_Dictionary/DataSourceDetails**

| | | | | |
|------------|--|------------|----------|------------|
| diagram |  | | | |
| type | DataSourceDetails | | | |
| attributes | Name | Type | Use | Annotation |
| | id | xsd:ID | required | |
| | type | xsd:string | optional | |
| annotation | <p>DataSourceDetails contains ids and descriptions of data sources (usually organizations) referenced by attribute "datasource" of complex datatype "PropertyData" in MPRD schema.</p> <p>DataSourceDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>DataSourceDetails also has one optional attribute, type, for specifying the type of the data source (examples include</p> | | | |

| | |
|--|--|
| | <p>"unpublished report," "journal," "handbook," etc.)</p> <p>Name contains the name of the data source defined under the authority.</p> <p>Notes contains any additional information concerning the data source.</p> <p>Example:</p> <pre><DataSourceDetails id="ds1" type="internet engineering references"> <Name>engineering toolbox</Name> <Notes>http://www.engineeringtoolbox.com</Notes> </DataSourceDetails></pre> |
|--|--|

element **MPRD_Dictionary/MeasurementTechniqueDetails**

| diagram |  | | | | | | | | | | | |
|------------|---|----------|------------|-----|------------|----|--------|----------|--|--|--|--|
| type | MeasurementTechniqueDetails | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| id | xsd:ID | required | | | | | | | | | | |
| annotation | <p>MeasurementTechniqueDetails contains ids and descriptions of measurement techniques referenced by attribute "technique" of complex datatype "PropertyData" in MPRD schema.</p> <p>MeasurementTechniqueDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>Name contains the name of the measurement technique defined under the authority.</p> <p>Notes contains any additional information concerning the measurement technique.</p> <p>Example:</p> <pre><MeasurementTechniqueDetails id="mt1"> <Name>Literature survey</Name> <Notes>The authors cite V.R. Pujari et al., "Development of Improved Processing and Evaluation Methods for High Reliability Structural Ceramics for Advanced Heat Engine Applications, Phase I," final report, ORNL/Sub/89-SB182/1, NTIS Rept. No. DE93-040528, August (1993), and summarize the procedure as follows. "The cylindrical buttonhead specimens were machined to ORNL design with a gauge diameter of 6.0±0.1 mm. ...50 mm diameter, 150 mm long specimens... were machined as many flexure bars (3 mm by 4 mm by 50 mm) for assessment of the properties across the 50-mm section."</Notes> </MeasurementTechniqueDetails></pre> | | | | | | | | | | | |

element **MPRD_Dictionary/ParameterDetails**

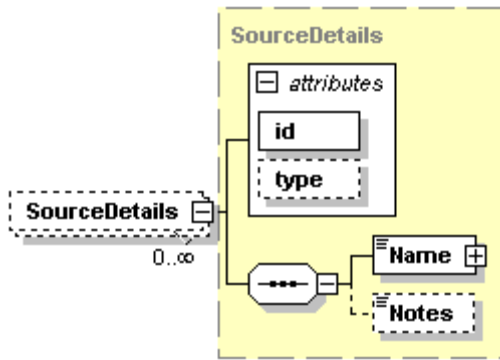
| diagram | | | | | | | | | |
|------------|---|----------|------------|-----|------------|----|--------|----------|--|
| type | ParameterDetails | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | |
| Name | Type | Use | Annotation | | | | | | |
| id | xsd:ID | required | | | | | | | |
| annotation | <p>ParameterDetails contains ids and descriptions of testing parameters referenced by attribute of complex type "ParameterValue" in MPRD schema.</p> <p>ParameterDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionay xml document.</p> <p>Name contains the name of the parameter defined under the authority.</p> <p>Units contains units for the parmater. There can be multiple units or no unit (unitless) definitions describing the parameter's units.</p> <p>Notes contains any additional information concerning the parameter.</p> <p>Example:</p> <pre><ParameterDetails id="pa1"> <Name>Test Temperature</Name> <Units name="C" description="degree Celsius"> <Unit name="C" power="1" description="degree Celsius"/> </Units> <Units name="F" description="degree Fahrenheit"> <Unit name="F" power="1" description="degree Fahrenheit"/> </Units> </ParameterDetails></pre> | | | | | | | | |

element **MPRD_Dictionary/PropertyDetails**

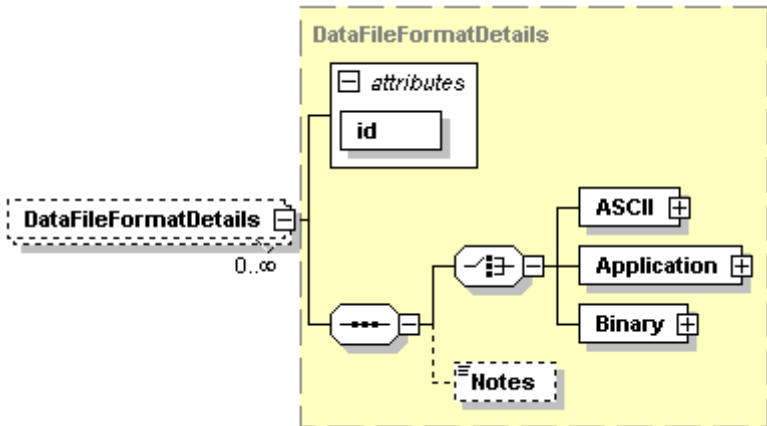
| diagram | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|------------|---|----------|---|-----|------------|----------|------------|----------|---|-----------|------------|--|---|------------|------------|--|---|----------|------------|--|---|------|------------|--|--|-----------|------------------------|--|---|-------|------------|--|---|
| type | PropertyData | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>property</td><td>xsd:string</td><td>required</td><td>attribute: property data id as defined in PropertyDetails section of MPRD_Dictionary.</td></tr><tr><td>technique</td><td>xsd:string</td><td></td><td>attribute: technique id as defined in MeasurementTechniqueDetails section of MPRD_Dictionary.</td></tr><tr><td>datasource</td><td>xsd:string</td><td></td><td>attribute: data source id as defined in DataSourceDetails section of MPRD_Dictionary.</td></tr><tr><td>specimen</td><td>xsd:string</td><td></td><td>attribute: specimen id as defined in SpecimenDetails in the Dictionary element.</td></tr><tr><td>test</td><td>xsd:string</td><td></td><td>attribute: test condition id as defined in TestConditionDetails in Metadata.</td></tr><tr><td>delimiter</td><td>derived by: xsd:string</td><td></td><td>attribute: delimiter specifies the delimiter that separates multiple values in the Data, Qualifier, Uncertainty, and ParameterValue elements. The default value is a comma (',').</td></tr><tr><td>quote</td><td>xsd:string</td><td></td><td>attribute: quote specifies the string that is used to quote values in the Data, Qualifier, Uncertainty and ParameterValue elements.</td></tr></table> | Name | Type | Use | Annotation | property | xsd:string | required | attribute: property data id as defined in PropertyDetails section of MPRD_Dictionary. | technique | xsd:string | | attribute: technique id as defined in MeasurementTechniqueDetails section of MPRD_Dictionary. | datasource | xsd:string | | attribute: data source id as defined in DataSourceDetails section of MPRD_Dictionary. | specimen | xsd:string | | attribute: specimen id as defined in SpecimenDetails in the Dictionary element. | test | xsd:string | | attribute: test condition id as defined in TestConditionDetails in Metadata. | delimiter | derived by: xsd:string | | attribute: delimiter specifies the delimiter that separates multiple values in the Data, Qualifier, Uncertainty, and ParameterValue elements. The default value is a comma (','). | quote | xsd:string | | attribute: quote specifies the string that is used to quote values in the Data, Qualifier, Uncertainty and ParameterValue elements. |
| Name | Type | Use | Annotation | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| property | xsd:string | required | attribute: property data id as defined in PropertyDetails section of MPRD_Dictionary. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| technique | xsd:string | | attribute: technique id as defined in MeasurementTechniqueDetails section of MPRD_Dictionary. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| datasource | xsd:string | | attribute: data source id as defined in DataSourceDetails section of MPRD_Dictionary. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| specimen | xsd:string | | attribute: specimen id as defined in SpecimenDetails in the Dictionary element. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| test | xsd:string | | attribute: test condition id as defined in TestConditionDetails in Metadata. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| delimiter | derived by: xsd:string | | attribute: delimiter specifies the delimiter that separates multiple values in the Data, Qualifier, Uncertainty, and ParameterValue elements. The default value is a comma (','). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| quote | xsd:string | | attribute: quote specifies the string that is used to quote values in the Data, Qualifier, Uncertainty and ParameterValue elements. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| annotation | PropertyDetails contains ids and descriptions of physical, chemical, mechanical, thermal, electrical and radiometric properties referenced by attribute "property" of complex type "PropertyData" in MPRD schema. PropertyDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| | |
|--|---|
| | <p>MPRD_Dictionay xml document.</p> <p>Optional attribute type contains the type of the property: "physical", "chemical", "electrical", "thermal", " mechanical" or "radiometric", etc.</p> <p>Name contains the name of the property defined under the authority.</p> <p>Units contains units for the parmater. There can be multiple units or no unit (unitless) definitions describing the property's units.</p> <p>Notes contains any additional information concerning the property.</p> <p>Example:</p> <pre><PropertyDetails id="physic-d" type="physical"> <Name>density</Name> <Units system="SI" name="kg/m^3" description="kilogram per cubic meter"> <Unit name="kg" power="1" description="kilogram"/> <Unit name="m" power="3" description="meter"/> </Units> <Notes>The density is defined as a mediums mass per unit volume.</Notes> </PropertyDetails></pre> |
|--|---|

element **MPRD_Dictionary/SourceDetails**

| | | | | | | |
|------------|--|------------|----------|---------|-------|------------|
| diagram |  | | | | | |
| type | SourceDetails | | | | | |
| attributes | Name | Type | Use | Default | Fixed | Annotation |
| | id | xsd:ID | required | | | |
| | type | xsd:string | optional | | | |
| annotation | <p>SourceDetails contains ids and descriptions of source of the material referenced by attribute "source" of complex type "Source" in MPRD schema.</p> <p>SourceDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionay xml document.</p> <p>Optional attribute type contains the type of the source: "government", "industry", "academic", etc.</p> <p>Name contains the name of the source defined under the authority.</p> <p>Notes contains any additional information concerning the source.</p> <p>Example:</p> <pre><SourceDetails id="s1" type="Government Source"> <Name>AFRL-MESA</Name> <Notes>AFRL Mesa provides this data under NAVAIR AWTD Joint IPT Program</Notes> </SourceDetails></pre> | | | | | |

element **MPRD_Dictionary/DataFileFormatDetails**

| diagram |  | | | | | | | | |
|------------|---|----------|------------|-----|------------|----|--------|----------|--|
| type | DataFileFormatDetails | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | |
| Name | Type | Use | Annotation | | | | | | |
| id | xsd:ID | required | | | | | | | |
| annotation | <p>DataFileFormatDetails contains ids and descriptions of data files referenced by attribute "dataFileFormat" of complex type "DataFile" in MPRD schema.</p> <p>DataFileFormatDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>ASCII element defines format for ASCII files. It defines the header labels of the tabular data, the corresponding units for the header labels, the row data delimiter and row data format.</p> <p>Application element defines format based on file types. It defines the header labels of the tabular data, the corresponding units for the header labels, the row data format.</p> <p>Binary element defines format for Binary files. It defines the header and record byte size, and data, record and file tokens.</p> <p>Notes contains any additional information concerning the data file format.</p> <p>Example:</p> <pre><DataFileFormatDetails id="ascii-1"> <ASCII delimiter=";"> <HeaderToSkip>5</HeaderToSkip> <ColumnLabels>Wavelength,Reflectance</ColumnLabels> <ColumnUnits>nm,%</ColumnUnits> <ColumnFormat>float,float</ColumnFormat> </ASCII> </DataFileFormatDetails></pre> | | | | | | | | |

element **MPRD_Dictionary/DataTableDetails**

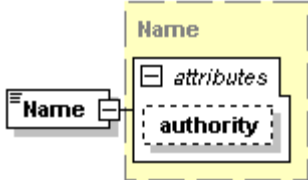
| diagram | | | | | | | | | |
|------------|--|----------|------------|-----|------------|----|--------|----------|--|
| type | DataTableDetails | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | |
| Name | Type | Use | Annotation | | | | | | |
| id | xsd:ID | required | | | | | | | |
| annotation | <p>DataTableDetails contains ids and descriptions of data tables referenced by attribute "dataTableFormat" of complex type "DataTable" in MPRD schema.</p> <p>DataTableDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>It defines the header labels of the tabular data, the corresponding units for the header labels, and the row data format.</p> <p>Example:</p> <pre><DataTableDetails id="tbl1"> <ColumnLabels num_columns="2">wavelength,reflectance</ColumnLabels> <ColumnUnits>um,%</ColumnUnits> <ColumnFormat>float,float</ColumnFormat> </DataTableDetails></pre> | | | | | | | | |

A.5.7 ParameterDetailscomplexType **ParameterDetails**

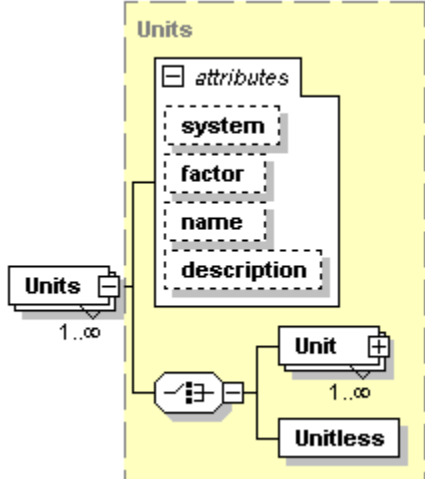
| diagram | <pre>graph LR PD[ParameterDetails] --- A[attributes] A --- ID[id] PD --- C(()) C --- Name[Name] C --- Units[Units] C -.- Notes[Notes] Units --- M[1..∞]</pre> | | | | | | | | |
|------------|--|----------|------------|-----|------------|----|---------------|----------|--|
| used by | element MPRD_Dictionary/ParameterDetails | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | |
| Name | Type | Use | Annotation | | | | | | |
| id | xsd:ID | required | | | | | | | |
| annotation | <p>Complex-type: ParameterDetails contains ids and descriptions of testing parameters referenced by attribute of complex type "ParameterValue" in MPRD schema.</p> <p>ParameterDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document.</p> <p>Name contains the name of the parameter defined under the authority.</p> <p>Units contains units for the parameter. There can be multiple units or no unit (unitless) definitions describing the</p> | | | | | | | | |

| | |
|--|---|
| | parameter's units. Notes contains any additional information concerning the parameter. |
|--|---|

element **ParameterDetails/Name**

| | | | | |
|------------|---|------------|----------|--|
| diagram |  | | | |
| type | Name | | | |
| attributes | Name | Type | Use | Annotation |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. |

element **ParameterDetails/Units**

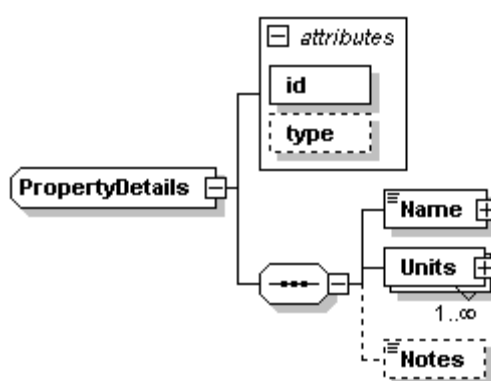
| | | | | |
|------------|--|------------|-----|--|
| diagram |  | | | |
| type | Units | | | |
| attributes | Name | Type | Use | Annotation |
| | system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." |
| | factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. |
| | name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s". |
| | description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second". |

element **ParameterDetails/Notes**

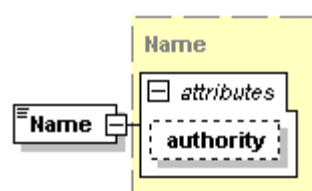
| | |
|---------|---|
| diagram |  |
| type | Notes |

A.5.8 PropertyDetails

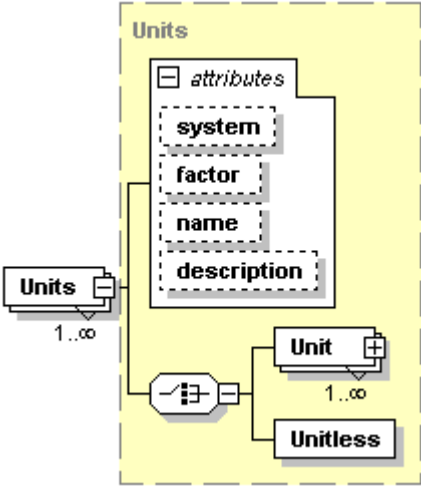
complexType **PropertyDetails**

| diagram |  | | | | | | | | | | | | | | | |
|------------|--|----------|------------|-----|------------|----|--------|----------|--|------|------------|----------|--|--|--|--|
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>id</td><td>xsd:ID</td><td>required</td><td></td></tr><tr><td>type</td><td>xsd:string</td><td>optional</td><td></td></tr></table> | Name | Type | Use | Annotation | id | xsd:ID | required | | type | xsd:string | optional | | | | |
| Name | Type | Use | Annotation | | | | | | | | | | | | | |
| id | xsd:ID | required | | | | | | | | | | | | | | |
| type | xsd:string | optional | | | | | | | | | | | | | | |
| annotation | <p>Complex-type: PropertyDetails contains ids and descriptions of physical, chemical, mechanical, thermal, electrical and radiometric properties referenced by attribute "property" of complex type "PropertyData" in MPRD schema.</p> <p>PropertyDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionay xml document.</p> <p>Optional attribute type contains the type of the property: "physical", "chemical", "electrical", "thermal", " mechanical" or "radiometric", etc.</p> <p>Name contains the name of the property defined under the authority.</p> <p>Units contains units for the parmater. There can be multiple units or no unit (unitless) definitions describing the property's units.</p> <p>Notes contains any additional information concerning the property.</p> | | | | | | | | | | | | | | | |

element **PropertyDetails/Name**

| diagram |  | | | | | | | | | | | |
|------------|---|----------|--|-----|------------|-----------|------------|----------|--|--|--|--|
| type | Name | | | | | | | | | | | |
| attributes | <table><tr><th>Name</th><th>Type</th><th>Use</th><th>Annotation</th></tr><tr><td>authority</td><td>xsd:string</td><td>optional</td><td>attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary.</td></tr></table> | Name | Type | Use | Annotation | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | |
| Name | Type | Use | Annotation | | | | | | | | | |
| authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. | | | | | | | | | |

element **PropertyDetails/Units**

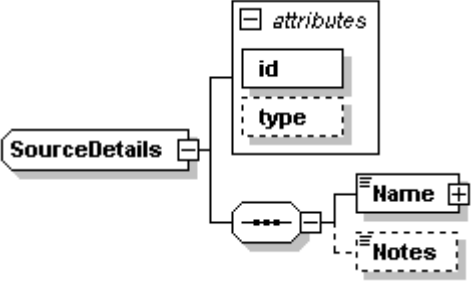
| | | | | |
|------------|---|------------|-----|--|
| diagram |  | | | |
| type | Units | | | |
| attributes | Name | Type | Use | Annotation |
| | system | xsd:string | | attribute: system is used to indicate the units system, such as "SI." |
| | factor | xsd:float | | attribute: factor is used to indicate a constant multiplier in floating point format. |
| | name | xsd:string | | attribute: name is used to indicate the name of the units. For example: "m/s". |
| | description | xsd:string | | attribute: description is used to describe the units. For example: "meter per second". |

element **PropertyDetails/Notes**

| | | | | |
|---------|---|--|--|--|
| diagram |  | | | |
| type | Notes | | | |

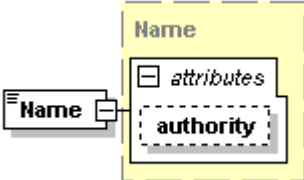
A.5.9 SourceDetails

complexType **SourceDetails**

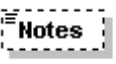
| | | | | |
|------------|---|------------|----------|------------|
| diagram |  | | | |
| used by | element MPRD_Dictionary/SourceDetails | | | |
| attributes | Name | Type | Use | Annotation |
| | id | xsd:ID | required | |
| | type | xsd:string | optional | |

| | |
|------------|---|
| annotation | <p>Complex-type: SourceDetails contains ids and descriptions of source of the material referenced by MPRD xml documents.</p> <p>Example: <SourceDetails id="s1" type="Government Source"> <Name>AFRL-MESA</Name> <Notes>AFRL Mesa provides this data under NAVAIR AWTD Joint IPT Program</Notes> </SourceDetails></p> <p>SourceDetails has one required attribute, id, which may be arbitrarily assigned but must be unique in the MPRD_Dictionary xml document. Name contains the name of the source defined under the authority. Notes contains any additional information concerning the source.</p> |
|------------|---|

element **SourceDetails/Name**

| | | | | |
|------------|---|------------|----------|--|
| diagram |  | | | |
| type | Name | | | |
| attributes | Name | Type | Use | Annotation |
| | authority | xsd:string | optional | attribute: authority id as defined in AuthorityDetails section of MPRD_Dictionary. |

element **SourceDetails/Notes**

| | | | | |
|---------|---|--|--|--|
| diagram |  | | | |
| type | Notes | | | |